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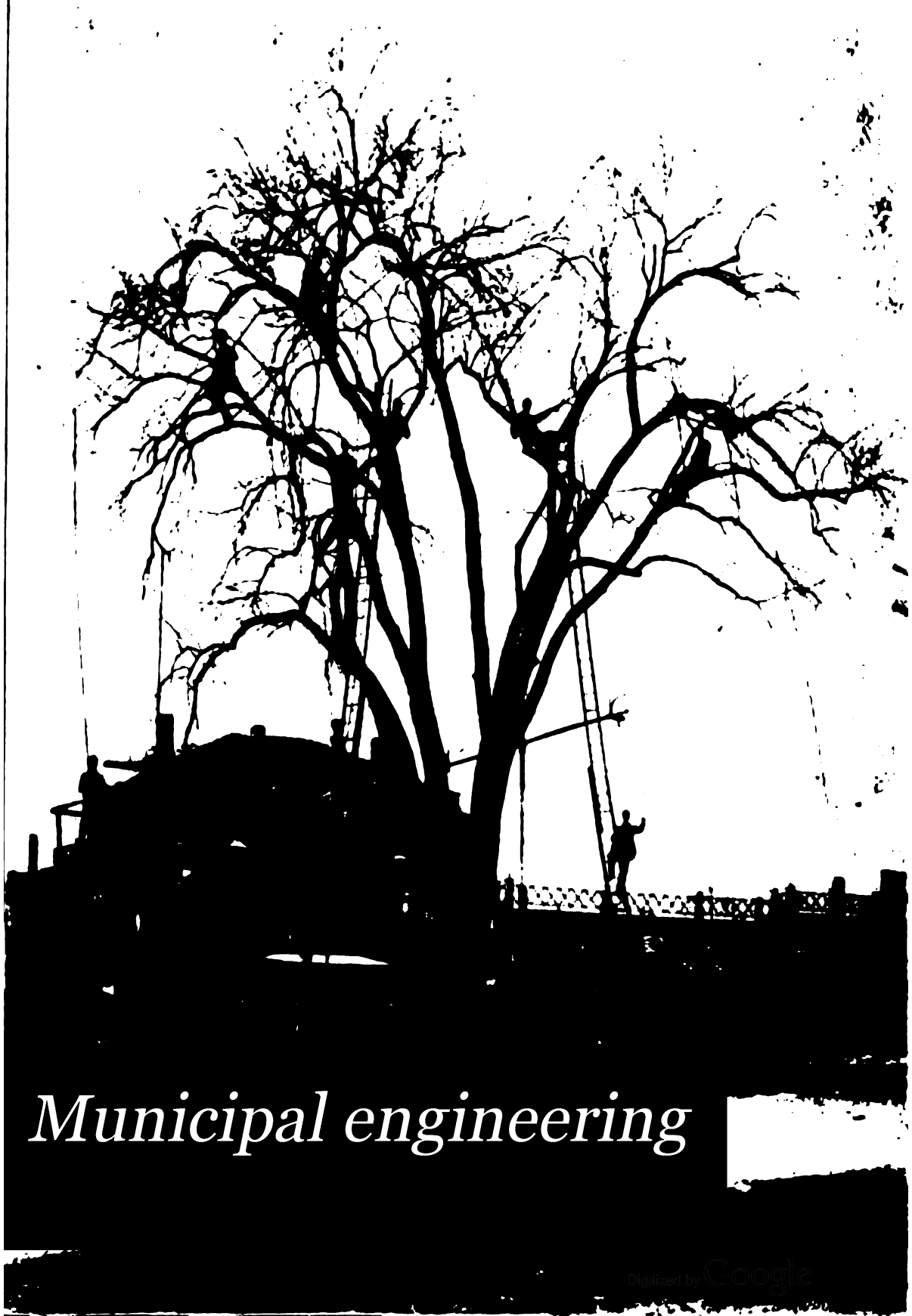

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MUNICIPAL ENGINEERING

VOLUME XXVI JANUARY, NINETEEN HUNDRED FOUR NUMBER ONE

THE SEPTIC TANK FOR THE TREATMENT OF SEWAGE AT THE SOLDIERS' HOME NEAR SANTA MONICA, CAL.

By James D. Schuyler, Consulting Engineer, Los Angeles, Cal.

In the summer of 1899 the question of sewage disposal at the Soldiers' Home became a serious one because of complaints by neighboring farmers living to leeward, of the odors arising from the sewage irrigated fields. Threats of injunction and suits for damage caused action to be taken by the Board of Managers of the Home, and the writer was employed to report upon the situation. Strong pressure was brought to bear on the management to induce them to connect their sewers with the sewerage system of Santa Monica, and dump their sewage into the ocean, four miles distant. This would have cost $20,000 for the necessary pipes and $800 a year for use of the outfall. The sewage had always been used for irrigating the vegetable garden at the Home, and had added greatly to its fertility. The supply of other water for irrigation is scanty, and expensive to procure The sewage was needed, and its waste was manifestly improper and unwise. The writer recommended the construction of a septic tank for the liquefying of the solids of the sewage, and the continued use of the sewage for irrigation on the grounds of the Home. Later he was employed to prepare plans for the tank, his recommendation having been approved, and a contract was let for its construction on Nov. 7, 1900, at a total cost of $2,535.05.

The work was completed Jan. 30, 1901, and the tank was put in service March 18 following. The contractor carried out his obligations faithfully, but suffered a loss of nearly $500, chiefly due to

The tank is 80 feet long, 20 feet wide, 10 feet deep, with a center wall, dividing it lengthwise into two compartments. These walls and the floor are of concrete. It is sunken entirely below the surface in an orchard of walnut trees and is covered with a roof of asphalt and gravel. It has been built in entire conformity with the plans, copy of which accompanies.

When the tank was first put in operation and during the last days of March the odor arising from the raw sewage in the tank was very offensive. This gradually decreased, and within a month or two became scarcely noticeable. Since then the operation of the tank has given entire satisfaction, and no complaints have been made. It has been cleaned out but once since it was put into service, and that was about a year after its use began. The writer was not present on this occasion, but the Chief Engineer of the Home stated that he found but a few inches of sandy or ashy sediment in the bottom.

The Home authorities are so well pleased with the action of the tank that they have made a requisition for another one for the treatment of the sewage from the Hospital, whose discharge was at too low an elevation to enter the present tank.

The only offensive odors which can now be detected arise from the ditches where the water is conveyed to the fields, and this is confined to a distance of a few hundred feet below the discharge end of the pipe. Sufficient attention is not al-

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summer of 1901 by Samuel Storrow, C. E. of this city, the associate of the writer in the construction of the tank, by an automatic registering device, with the following result:

From 6 p. m. to 6 a. m. ...	27,297 gallons
From 6. a. m. to 6. p. m. ...	66,743 gallons
Total for 24 hours of	94,050 gallons

This was an increase of about 20,000 gallons daily over the gaugings made by the writer in May 1899. The volume of sewage has further increased in the past two years, as the population of the Home is steadily increasing, but no measurement has recently been made. It may now reach an average of 125,000 gallons daily, although this is merely an estimate.

Mr. Storrow also measured the flow from the hospital sewer for 68 hours, from July 26th to 29th, 1901, and found it fluctuating through such a wide range as to require a provision for handling 75,000 gallons daily, or an increase of 50 per cent over the maximum rate of discharge. Because of the desirability of destroying pathogenic germs existing in the hospital sewage, a special treatment has been recommended in addition to the septic tank for purifying the effluent by intermittent filtration.

The accompanying photographs illustrate the construction of the tank.

The tank has been inspected by many visitors, and its operation is universally conceded to be successful, and all that could be expected from a septic tank short of complete clarification and purification. The effluent has a cloudy, milky appearance, with flocculent black specks, carried in suspension.

Following are extracts from the specifications under which the construction of the septic tank was done.

The general size of the tank, inside measurement, is that of two parallel tanks, each ten feet wide by eighty feet long; nine feet deep at one end and nine and one-half feet deep at the other with a sand box at the deeper end. The tanks are built separated by a center wall but are built throughout as one piece of

When there is cause to measure the brickwork it shall be counted by actual kiln count and not by measure.

All brickwork must be laid up with good hard-burned or the best mercantile bricks, acceptable to the engineer, laid in mortar with shove joints.

All bricks shall be well wet before laying. Each brick shall be laid with a shove joint in a full bed of cement, all the interstices being thoroughly filled. Every fourth course shall consist of a heading course of whole brick, extending through the entire thickness of the wall. All courses of brickwork shall be kept level and bonds shall be carefully preserved. When necessary to bring any course to the required hight, clipped courses shall be formed, as in no case shall any joints finish more than one-half inch thick. All brickwork shall be laid to the lines and all walls must be built firm, true, plumb, out of wind and square. Tops of walls must be carefully built up around the roof joints. All grooves in the masonry shall be filled up snugly around the cross partitions, which are to be put in place as the work progresses.

All brick work shall be laid in a mortar composed of one part by measure of fresh cement and 2½ parts by measure clean, sharp sand, properly screened, and mixed with sufficient water to render the mixture of proper consistency. Care must be taken to thoroughly mix the sand and cement dry in the proper proportions before adding the water. The mortar shall be mixed in small quantities only and in no case shall mortar that has commenced to set or stood over night be used.

The masonry work shall be erected by first excavating the material to the full cube of the completed structure, and then building the walls of the tank to their full hight, establishing these walls on a firm and well-set footing, as shown in the sections and drawings. After the cement in the walls has become well set and hard, the floor shall be laid with a grade of six inches from the sides to the center of each floor. The man-hole in the center of the tank shall be built upward with

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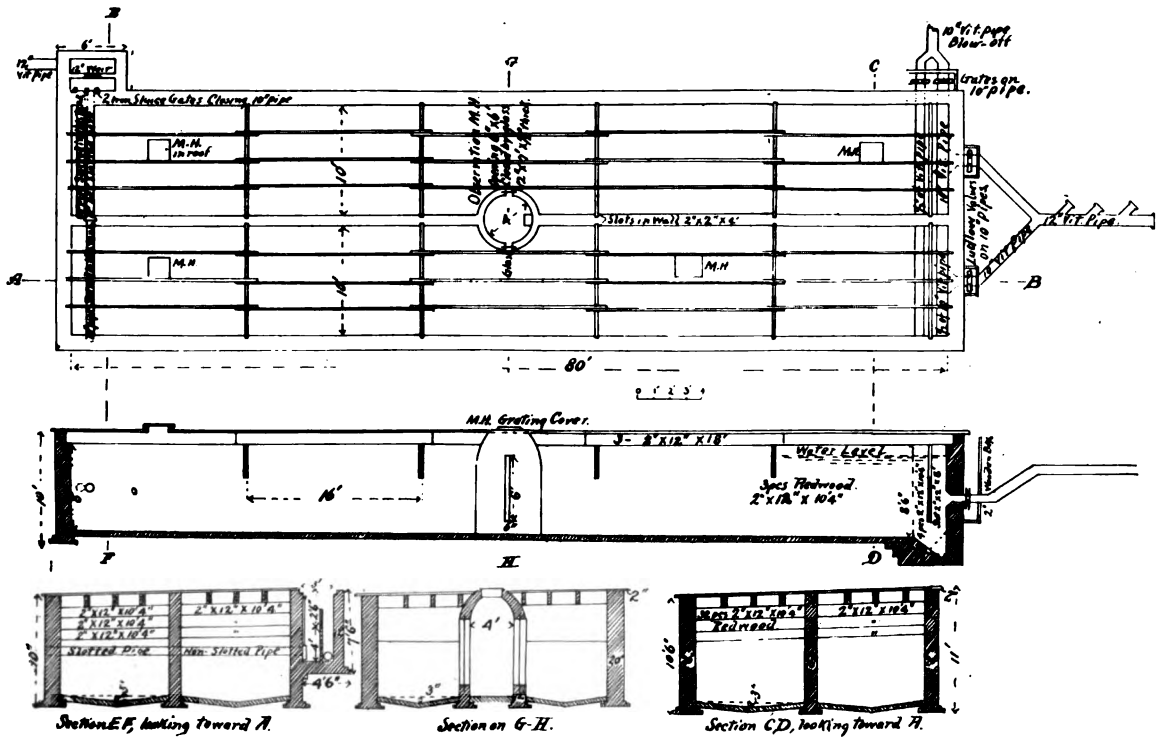
B
6'
12" V.C.P.
6" Vent
2 Iron Sluice Gates Closing 18" pipe
M.H. in roof
M.H.
M.H.
Observation M.H.
Manhole 3'-0" Diameter
Cast Iron Steps
Slots in Wall 2"x2"x4'
10'
A
A'
80'
M.H. Grating Cover.
3- 2"x12"x18'
Water Level
16'
Specs Redwood.
2"x12"x10'4"
Slotted Pipe
Non-Slotted Pipe
4'6"
Section E.F. looking toward A.
Section on G-H.
Section C.D. looking toward A.

shall receive a coating of California silicate compound, to be composed of 69 parts of clean sand, small enough to pass through a 20 mesh screen, and thirty parts of pure sulphur, and one-third part each of sal ammoniac, litharge and whiting, all to be melted and mixed together at a heat of not less than 550 degrees Farenheit; then allowed to cool, and then against brought to the melting point under a steady heat and held there by a constant fire. This preparation shall be applied to the walls with a brush in not less than two coats, and a third coat when necessary to bring the total thickness of the coating to not less than three-eighths of an inch, care being taken in heating and applying the material so that there shall be no blow-holes or bubbles in the finished work, and that the coatings shall be even and well brushed down.

The contractor is to set all iron work shown in the drawings or specified in such a way that it shall be firmly cemented into masonry, and the frame of the sluice gates in the discharge box shall be set in the masonry in such a way as to make a strong and water-tight connection. The 10-inch slotted discharge pipes shall be 10-inch cast-iron pipes one-half inch thick, with two holes, each one inch in diameter, bored in line and ten feet apart and with a slot mil ed through the pipe connecting these holes but not passing out the end of the pipe; when set in place these pipes shall have their bell ends imbedded in the masonry. The two ten-inch blow-off valves and the two ten-inch entrance valves shall be leaded onto a piece of ten-inch cast iron pipe, and this pipe shall be bedded in the masonry so as to make a strong and firm connection.

The weir in the discharge box shall be made up out of one-eighth-inch iron with a horizontal crest and vertical sides, projecting at least two inches clear of the masonry.

The 12-inch vitrified discharge and the 10-inch vitrified blowoff pipe shall be furnished and laid with cement joints in a trench excavated to the depth shown in the drawing and back-filled, all by the contractor, all on a uniform grade. The manhole shall be set with a cast-iron grating cover set in a cast-iron ring of standard sewer manhole pattern as used by the city of Los Angeles and approved by the engineer. The four 10-inch valves shall be set in two boxes made of two-inch redwood lumber with a cover set six inches above the ground.

The two iron sluice gates in the discharge chamber shall be of a good and substantial pattern, moving in a guide frame which shall be built into masonry. The slotted pipe shall be a ½-inch thick 10-inch cast-iron water-pipe, having a slot one inch wide by ten feet long milled out of two of the three sections of pipe and it shall be so set in the masonry that this slot shall come at the bottom and so that the bell ends shall be imbedded in the masonry. The roof-stringers shall be steadied by 2x4-inch cross-bracing cut in over the two center cross partitions and two square manholes shall be left in the roof near the discharge end fitted with tight wooden covers similar to skylight covers. The whole roof shall then be covered with a roofing paper, tar and gravel, or such an equivalent as shall be previously accepted by the engineer.

All concrete shall be mixed in the proportion of one of cement, three of clean sharp sand, and five parts of gravel, all measured, well screened and washed; the gravel to be of all sizes from pea size up to dimensions that will pass through a two-inch ring. The mixing shall be done on a tight platform and the materials shall be thoroughly mixed dry, before applying water. They shall be turned over by hand not less than three times dry, and three times after wetting. If the management accepts bids for concrete walls instead of brick all the walls must be molded true, plumb, out of wind, and of uniform thickness, and so thoroughly rammed as to leave no spaces or holes when the molds are removed. The concrete must be spread in layers of not more than six inches in thickness and evenly and thoroughly tamped so as to avoid bridging of materials over hollow spaces and so as to secure a perfect monolithic structure. If any portion of the wall has become set hard on the surface before completion, the surface shall be cleaned and coated with a wash of pure cement before the next layer is applied in order to secure a perfect bond. The work must be kept shaded from the sun and frequently moistened for ten days after setting. The concrete in the floor must be thoroughly tamped and troweled to a smooth and uniform surface at the one operation.

Cement—The contractor will be required to furnish the engineer with certified copies of the manufacturers' tests of each batch of ten barrels of the cement proposed to be furnished for the work and permit him to take such samples free of charge as he may desire for testing. All cement used shall conform to

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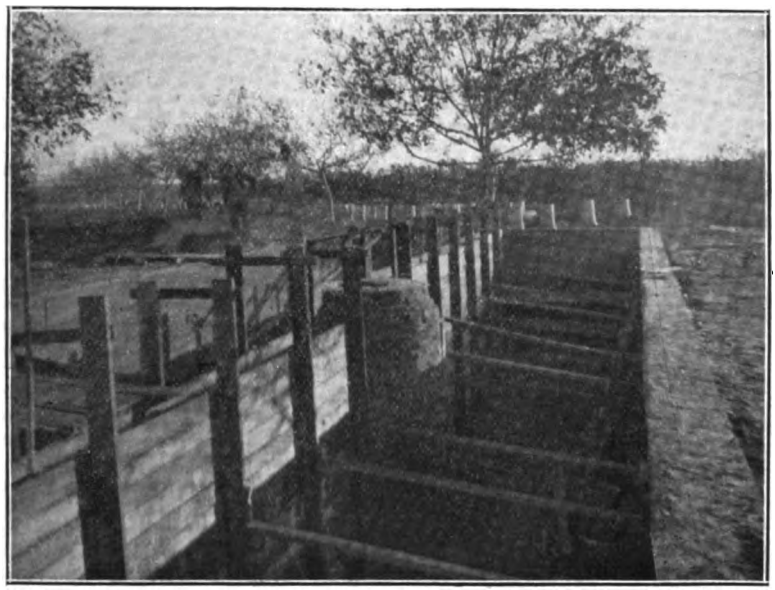
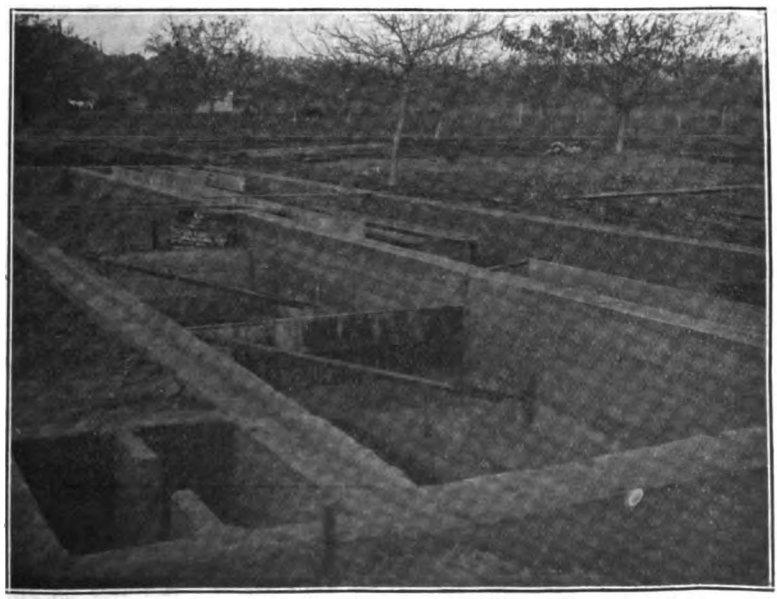


Sidewalls and Manhole Completed. Forms for Middle Wall in Place.



Tank Completed Except Cover.

SEPTIC TANK, SOLDIERS' HOME, SANTA MONICA, CAL.

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the requirements as to tensile strength and fineness, time of setting, etc., required in the specifications of the City of Los Angeles for the cement used in the Third-st. and Broadway tunnels, and be equal in every respect to the best cement manufactured by the Colton Cement Company. Any cement delivered at the site of the work which fails to meet these requirements and tests shall be removed at once from the premises and not used in any part of the work.

Gravel Roof—The roof is to be composed of one inch pine boards of good quality, surfaced on one side sufficiently to ensure a uniform thickness throughout and avoid any irregularity of top surface. The boards shall be closely laid and securely nailed to all the stringers and project a uniform distance of two inches beyond the walls all around. The boards are then to be covered with P. & B. mastic composition asphalt and gravel roofing, consisting of three layers of two-ply P. & B. waterproof felt smoothly spread upon the boards but not nailed thereto. Between each of the layers of the felt a heavy coating of hot refined asphalt will be spread with mops, and the top surface will be flooded with a hot coating of refined asphalt heavily mopped on. While still hot, there must be imbedded in this coating of asphalt a layer of forty-inch burlap, tightly stretched over the entire roof surface. The surface of the burlap thus prepared shall then be treated to two heavy coatings of refined asphaltum, to be poured on hot and spread evenly with mops; the first spreading of the mop to fill all the pores of the burlap and the second coating, to be put on immediately afterward, must entirely flood the surface, after which the whole surface of the roof shall receive an application of clean, dry, well screened gravel of pea size, swept on uniformly and evenly while the last asphalt coating is still hot, the gravel to be thoroughly dry and warm. The edges of the roofing shall be tacked to the edges of the boards, and trimmed to the outer edge, and a margin shall be formed with a strip of No. 18 galvanized iron bent to proper form, lapping two inches on top and one and one-half inches down the side, with a folded projection above to a level with the flush top of the finished roof. A neat, tight connection shall be made to all openings in the top of the roof. The contractor will be required to guarantee the water-tightness of the roof for a period of five years, giving an acceptable bond to perform all repairs needed within that period promptly on notification that the roof requires repair.

A tight connection shall be made all around between the roof and the walls, and all spaces so thoroughly filled with mortar as to make the tank practically air tight and prevent the leakage of gas

Backfilling—All the excavation outside of the tank, below the floor, and elsewhere, must be refilled with good material well tamped and wet down.

PORTLAND CEMENT MANUFACTURE.*

Burning the Mixture.

By Edwin C. Eckel, U. S. Geological Survey, Washington, D. C.

After the cement mixture has been carefully prepared, as described in preceding papers of this series, it must be burned with equal care. In the early history of the Portland cement industry various types of kilns were in use at different plants, patented continuous kilns of several styles being particularly favored in European mills, but, at present, practice in burning at the different American cement plants is rapidly approaching uni- almost invariably of the rotary type, the rotary process, which is essentially American in its development, being based upon the substitution of machines for hand labor wherever possible. A brief summary of the process will first be given, after which certain subjects of interest will be taken up in more detail.

Summary of Burning Process—As at present used the rotary kiln is a steel cylinder about six feet in diameter, the

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This cylinder is set in a slightly inclined position, the inclination being approximately one-half inch to the foot. The kiln is lined, except near the upper end, with very resistant fire brick, to withstand both the high temperature to which its inner surface is subjected and also the destructive action of the molten clinker.

The cement mixture is fed in at the upper end of the kiln, while fuel which may be either powdered coal, oil or gas —is injected at its lower end. The kiln, which rests upon geared bearings, is slowly revolved about its axis. This revolution, in connection with the inclination at which the cylinder is set, gradually carries the cement mixture to the lower end of the kiln. In the course of this journey the intense heat generated by the burning fuel first drives off the water and carbon dioxide from the mixture and then causes the lime, silica, alumina and iron to combine chemically to form the partially fused mass known as "cement clinker." This clinker drops out of the lower end of the kiln, is cooled so as to prevent injury to the grinding machinery, and is then sent to the grinding mills.

Theoretical Fuel Requirements—As a preliminary to a discussion of actual practice in the matter of fuel, it will be of interest to determine the heat units and fuel theoretically required in the manufacture of Portland cement from a dry mixture of normal composition.

In burning such a mixture to a clinker, practically all of the heat consumed in the operation will be that required for the dissociation of the lime carbonate present into lime oxide and carbon dioxide. Driving off the water of combination that is chemically held by the clay or shale, and decomposing any calcium sulphate (gypsum) that may be present in the raw materials, will require a small additional amount of heat. The amount required for these purposes is not accurately known, however, but is probably so small that it will be more or less entirely offset by the heat which will be liberated during the combination of the lime with the silica and alumina. We may, therefore, without sensible error, regard the total heat theoretically required for the production of a barrel of Portland cement as being that which is necessary for the dissociation of 450 pounds of lime carbonate. With coal of a thermal value of 13,500 B. T. U., burned with only the air supply demanded by theory, this dissociation will require 25½ pounds of coal per barrel of cement, a fuel consumption of only 6.6 per cent.

Losses of Heat in Practice—In practice with the rotary kiln, however, there are a number of distinct sources of loss of heat, which result in a fuel consumption immensely greater than the theoretical requirements given above. The more important of these sources of loss are the following:

1. The kiln gases are discharged at a temperature much above that of the atmosphere, ranging from 300 F. to 2,000 F., according to the type of materials used and the length of the kiln.

2. The clinker is discharged at a temperature varying from 300 F. to 2,700 F., the range depending as before on materials and length of the kiln.

3. The air supply injected into the kiln is always greater, and usually very much greater, than that required for the perfect combustion of the fuel; and the available heating power of the fuel is thereby reduced.

4. Heat is lost by radiation from the ends and exposed surfaces of the kiln.

5. The mixture, in plants using a wet process, carries a high percentage of water, which must be driven off.

It is evident, therefore, that present-day working conditions serve to increase greatly the amount of fuel actually necessary for the production of a barrel of cement above that required by theory.

Actual Fuel Requirements and Output—Rotary kilns are nominally rated at a production of 200 barrels per day per kiln. Even on dry and easily clinkered materials and with good coal, however, such an output is rarely attained. Normally, a kiln working on a dry mixture will produce from 140 to 180 barrels of cement per day of twenty-four hours. In doing this, if good coal is used, its fuel consumption will commonly be from 120 to 140 pounds of coal per barrel of cement, though it may range as high as 160 pounds, and, on the other hand, has fallen as low as 90 pounds. An output of 160 barrels per day, with a coal consumption of 130 pounds per barrel, may therefore be considered as representing the results of fairly good practice on dry materials. In dealing with a wet mixture, which may carry anywhere from 30 to 70 per cent. of water, the results are more variable, though always worse than with dry materials. In working a sixty-foot kiln on a wet material, the output may range from 80 to 140 barrels per day, with a fuel consumption of from 150 to 230 pounds per barrel. Using a longer kiln, partly drying

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the mix, and utilizing waste heat will, of course, improve these figures materially.

When oil is used for kiln fuel, it may be considered that one gallon of oil is equivalent in the kiln to about ten pounds of coal. The fuel consumption, using dry materials, will range between 11 and 14 gallons of oil per barrel of cement; but the output per day is always somewhat less with oil fuel than where coal is used.

Natural gas, in the kiln, may be compared with good Pennsylvania coal by allowing about 20,000 cubic feet of gas as equivalent to a ton of coal. This estimate is, however, based upon too little data to be as close as those above given for oil or coal.

Effect of Composition on Burning—The differences in composition between Portland cement mixtures are very slight if compared, for example, to the differences between various natural cement rocks. But even such slight differences as do exist exercise a very appreciable effect on the burning of the mixture. Other things being equal, any increase in the percentage of lime in the mixture will necessitate a higher temperature in order to get an equally sound cement. A mixture which will give a cement carrying 59 per cent. of lime, for example, will require much less through burning than would a mixture designed to give a cement with 64 per cent. of lime.

With equal lime percentages, the cement carrying high silica and low alumina and iron will require a higher temperature than if it were lower in silica and higher in alumina and iron. But, on the other hand, if the alumina and iron are carried too high, the clinker will ball up in the kiln, forming sticky and unmanageable masses.

Character of Kiln Coal—The fuel most commonly used in modern rotary kiln practice is bituminous coal, pulverized very finely. Coal for this purpose should be high in volatile matter, and as low in ash and sulphur as possible. Russell gives the following analyses of West Virginia and Pennsylvania coals used at present at various cement plants in Michigan.

—Analyses of Kiln Coals—

Fixed carbon	56.15	56.33	55.82	51.69
Volatile matter	35.41	35.26	39.37	39.52
Ash	6.36	7.06	3.81	6.13
Moisture	2.08	1.35	1.00	1.40
Sulphur	1.30	1.34	0.42	1.46

The coal as usually bought is either "slack" or "run of mine." In the latter case it is necessary to crush the lumps before proceeding further with the preparation of the coal, but with slack this preliminary crushing is not necessary, and the material can go directly to the dryer.

Drying Coal—Coal as bought may carry as high as 15 per cent. of water in winter or wet season. Usually it will run from 3 to 8 per cent. To secure good results from the crushing machinery it is necessary that this water should be driven off. For coal drying, as for the drying of raw materials, the rotary dryer seems best adapted to American conditions. It should be said, however, that in drying coal it is usually considered inadvisable to allow the products of combustion to pass through the cylinder in which the coal is being dried. This restriction serves to decrease slightly the possible economy of the dryer, but an evaporation of 6 to 8 pounds of water per pound of fuel coal can still be counted on with any good dryer. The fuel cost of drying coal containing 8 per cent. of moisture, allowing $2 per ton for the coal used as fuel, will therefore be about 3 to 4 cents per ton of dried product.

Pulverizing Coal—Though apparently brittle enough when in large lumps, coal is a difficult material to pulverize finely. For cement kiln use, the fineness of reduction is very variable. The finer the coal is pulverized, the better results will be obtained from it in the kiln; and the poorer the quality of the coal, the finer it is necessary to pulverize it. The fineness attained in practice may therefore vary from 85 per cent. through a 100 mesh sieve, to 95 per cent. or more through the same. At one plant a very poor but cheap coal is pulverized to pass 98 per cent. through a 100 mesh sieve, and in consequence gives very good results in the kiln.

Coal pulverizing is usually carried on in two stages, the material being first crushed to 20 to 30 mesh in a Williams mill or ball mill, and finally reduced in a tube mill. At many plants, however, the entire reduction takes pace in one stage, Griffin or Huntingdon mills being used.

Total Cost of Coal Preparation—The total cost of crushing (if necessary), drying and pulverizing coal, and of conveying and feeding the product to the kiln, together with fair allowances for replacements and repairs, and for interest on the plant, will probably range from about 20 cents to 30 cents per ton of dried coal, for a four-kiln plant. This will be equivalent to a cost of from 3 to 5 cents per barrel of cement. While this may seem a heavy addition to the cost

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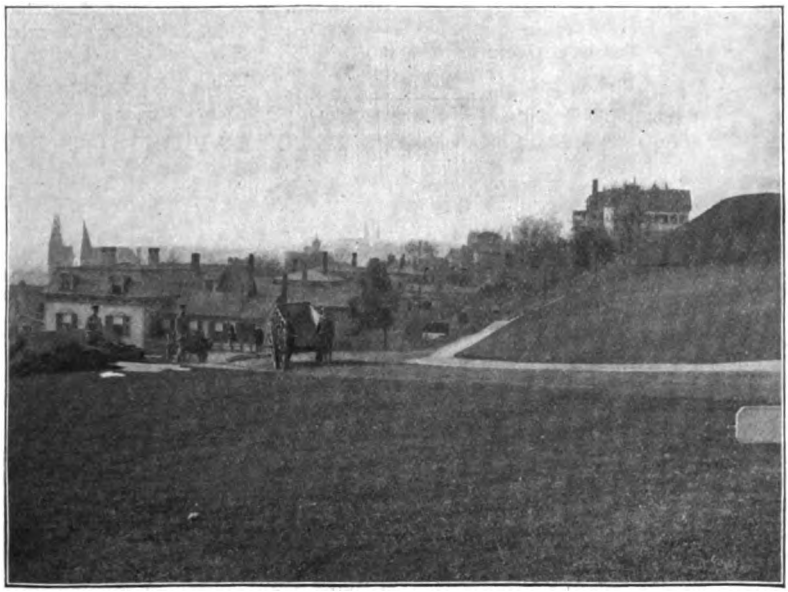
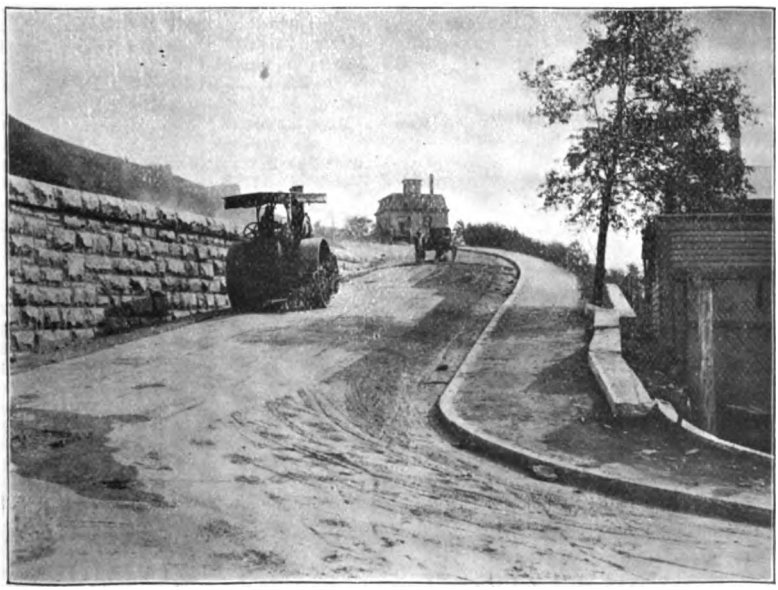


PROSPECT HILL PARKWAY, SOMERVILLE, MASS.



PROSPECT HILL PARK DRIVE, SOMERVILLE, MASS.

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of cement manufacture, it should be remembered that careful drying and fine pulverizing enable the manufacturer to use much poorer—and therefore cheaper—grades of coal than could otherwise be utilized.

CRITICISMS OF ASPHALT PAVING ESTIMATES AT DETROIT, MICH.

By W. F. Raymond, Indianapolis, Ind.

On page 435 of the December issue of Municipal Engineering, under the heading of "Asphalt Paving Estimates in Detroit," there is given the synopsis of a report by Mr. C. A. Proctor to the Council Committee on streets for the city of Detroit, Mich., under date of Nov. 17 last.

There is much of value in the report, much worthy of commendation, but from the synopsis it is very inaccurate and incomplete and very misleading. Following the items as reported, take first

Plant and Maintenance—Primarily the appropriation of $10,000 for installation of a plant capable of such capacity as figured upon is insufficient to meet the requirements of modern improved and constantly improving methods in plant construction and devices; $12,500 to $15,000 would undoubtedly be needed.

Secondly, but one roller is figured on at a less cost than $2,500. What becomes of surface rolling on new and re-surface work? And if done by hand-rollers what allowance has been made for the extra men required on the street to manipulate the hand-roller?

Modern methods and those conceded best do not admit of surface rolling with a hand roller, but require one of at least 2½ tons (steam); this, therefore, would mean an additional outlay for a second steam roller. Another point is that one roller cannot properly do surface and finish work for 1,500 square yards of paving in a day, hence another necessity for two rollers. The other figures for cost of plant submitted in the report are quite fair, though from the above it will be seen that interest and maintenance cost must be brought higher because a greater principal is required.

Cost of Binder and Labor—In binder items the report shows plant labor costs in excess of that of street labor. This should accurately apply to new work alone. Where binder is used for repairs the cost of labor on the street exceeds by far the labor cost at the plant. To for the plant (new work and repairs;) second, for street labor, using binder and top, both on new work and repairs; these figures are based on some years experience with work under normal average economical conditions.

PLANT LABOR—NEW WORK—BINDER OR TOP.

1	Foreman	$ 4.00
1	Engineer	3.50
1	Assistant Engineer	2.50
1	Mixerman	2.00
1	Dust Man	1.75
2	Drum Firemen	3.50
1	Tank Man	1.75
1	Utility Man	1.75
1	Office Boy	1.00
1	Water Boy	.75
1	Watchman	1.50
10	Laborers	15.00
	Total	$39.00

PLANT LABOR—REPAIR WORK.

1	Foreman	$ 4.00
2	Engineers	3.50
1	Assistant Engineer	2.50
1	Mixer Man	2.00
1	Utility Man	1.75
2	Firemen	3.50
1	Dust Man	1.75
1	Tank Man	1.75
1	Office Boy	1.00
1	Water Boy	.75
1	Watchman	1.50
6	Laborers	9.00
	Total	$33.00

STREET LABOR—BINDER—NEW WORK.

1	Foreman	$ 4.00
1	Timekeeper	2.00
1	Engineer	3.50
1	Helper	1.50
3	Rakers	6.75
2	Tampers	4.00
1	Joint Painter	1.50
2	Wagon Dumpers	3.50
1	Utility Man	1.75
*5	shovelers	8.75
1	Watchman	1.50
	Total	$38.75

* Smoothers are usually used as shovel-

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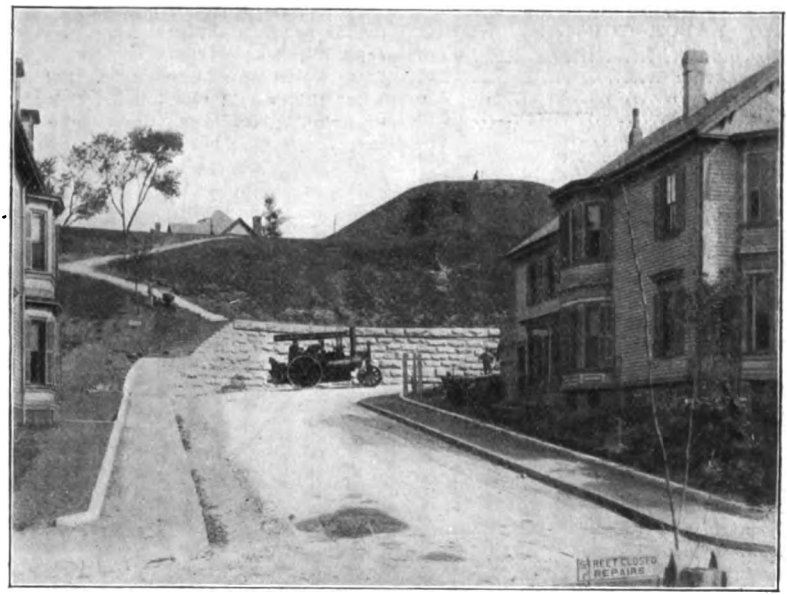
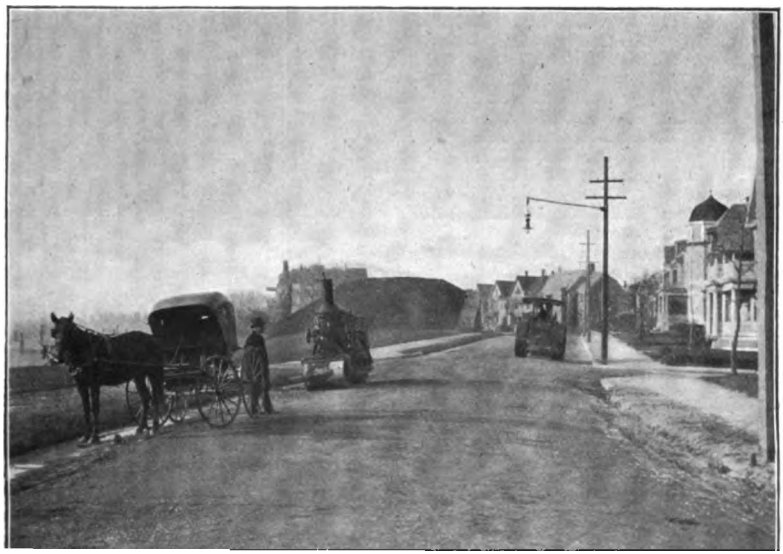


STONE AVENUE EXTENSION, SOMERVILLE, MASS.



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STREET LABOR—TOP—NEW WORK.

	1 Foreman	$ 4.00
	1 Timekeeper	2.00
	1 Engineer	3.50
	1 Engineer	3.00
	3 Rakers	6.75
(a)	2 Tampers	4.00
	2 Smoothers	4.00
	1 Painter	1.50
(b)	1 Utility Man	1.75
	2 Wagon Dumpers	3.50
	4 Shovelers	7.00
	1 Watchman	1.50
	Total	$42.50

(a) In case of work between street car rails two more tampers and one more shoveler would be needed making cost $5.75 a day more or a total of $48.25.

(b) Used chiefly as cement sweeper.

In figuring for binder and top for repairs and cut holes, the distribution of charges cannot be much more fairly made than by assigning one-third to binder and two-thirds to top. For this reason but one list for labor required is given, and the cost may be distributed accordingly. The holes must be made ready, the dirt and old material cleaned up, so a truly accurate distribution of binder cost and top cost is next to impossible. The labor needed on asphalt repairs, whether laid with or without binder, follows:

STREET LABOR—REPAIRS.

	1 Foreman	$4.00
	1 Timekeeper	2.00
(1)	2 Engineers	6 50
(2)	3 Tampers	6.00
	2 Smoothers	4.00
	1 Joint Painter	1.50
	1 Water-boy	1.00
	3 Shovelers	5.25
	1 Utility man (sweeper)	1.75
	2 Men cleaning up	3.00
	3 Joint Cutters	5.25
	3 Men breaking out	4.50
	1 Man cleaning out holes	1.50
	1 Watchman	1.50
(3)	2 Teams cleaning up	7.00
	Total	$54.75

(1) On patches over four or five feet square surface rolling is necessary. Two rollers should therefore be used.

(2) Oftentimes where the patches are many and small four tampers are necessary to keep up with the rakers.

(3) If haul to dump is at all long, two teams will be needed to clean up, though sometimes one will do, if on the last turn nearly accurate daily average of yardage, especially where binder is used, would be from 400 to 500 square yards. Let us see what this would mean in cost, including material, plant and street labor, with maintenance and repairs left out. The following table is based on 500 square yards of paving laid in one ten-hour day, three-inch wearing surface, one-inch binder, two-inch top.

TOTAL REPAIR COST.

Street pay-roll	$ 54 75
Plant pay-roll	33 00
46 boxes binder	99 84
84 boxes top	318 22
Coal and fuel (plant)	30 00
Coal and fuel (street)	4 50
Hauling, five teams at $4.50	22 50
Total	$562 81
Cost per yard	$1 12

Between these figures and those of Mr. Proctor at 67c a square yard, on 500 square yards of repair work, including asphalt and binder, there is a difference of $107.81 on a very good day's work. Some consideration must be given, however, to the fact that in these estimates Mr. Proctor's figures for fuel, for stone, for teams and asphalt have been given, the remaining items being figured from prices ruling in Indiana, and more especially Indianapolis.

In the estimate of forty-six boxes of binder the amount of asphalt cement required was figured at a minimum, and very clear lime stone would be necessary to keep within this estimate. In the eighty-six boxes of top allowance was made for each ten-foot box of surface mixture to lay practically six (6) square yards of pavement; in binder each ten-foot box to lay a little more than ten (10) square yards, though it should run eleven or a little more, especially in repairs at one-inch thickness. Further, in the asphalt charges the stone dust allowance was liberal, but not too great by many cents, dependent greatly on freight rates and whether ground at the plant of the user or received ready for use.

Now as to new work, if 1,500 square yards of two-inch asphalt was laid in a day the total plant and street labor plus the cost of materials, but less the cost

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HANCOCK STREET, SOMERVILLE, MASS.
Before Improvement.

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as the discount could apply only to materials.

The estimates for new work by Mr. Proctor are quite too low for another reason, since he makes no allowance for stormy days, for days or even hours when the plant or one of the rollers breaks down and he must pay many of his men full or at least half time in order to retain the class of skilled labor which the proper laying of asphalt demands.

Data and figures covering many pages could be written on this subject, showing cost prices under varying conditions, but it must ever be borne in mind that vast differences exist between new and repair work; also, that the use of binder on any work makes a vast difference in cost, thickness of the asphalt surface, too, being all important in figuring. Were it possible to lay 1,500 square yards of 2 in. top six days a week, and every week from April to November, then one could say that 67c a square yard was a good price for municipalities, but taking all things into consideration a contractor should hesitate a long time before he signed a contract for any kind of asphalt work for less than $1 per square yard.

Theoretically, 67c per sq. yard is very attractive to the municipality in quest of good streets at the lowest possible cost; practically, over $1 per sq. yard would be found to be the nearest approximate average cost. Should a municipality have thousands of yards of new work to lay and many of repairs no doubt it could save money by doing its own work, cost of plant not considered, for on days and in seasons when new work should not be done for satisfactory results many repairs could properly be made. The idea is a good one and should be tried, but only after most thorough investigation, and under the direct management of a hustling, competent man of long and successful experience.

THE STREETS OF SOMERVILLE, MASS.

The pictures in the reports of Mr. John

JOHN P. PRICHARD,
Street Commissioner, Somerville, Mass.

P. Prichard, who is Street Commissioner and a member of the Board of Public Works of Somerville, Mass., show the quality of the work done under his department even better than the text. All the work is done by day labor and nearly all the street construction is macadam. The pictures show the road rollers, of which the city has one fifteen-ton, one twelve-ton and a five-ton asphalt roller. The streets reconstructed in 1902, three-fourths of them wholly, measured 26,788 feet in length and the total cost was $21,338.53.

Two of the pictures show the brown-tail moth and the process of removing it from the trees. The street commissioner is waging vigorous war against the pest, and says the city is not yet free. The work of removal cost $6,092.07 in 1902. With these explanations and the titles under the pictures they will speak for themselves.

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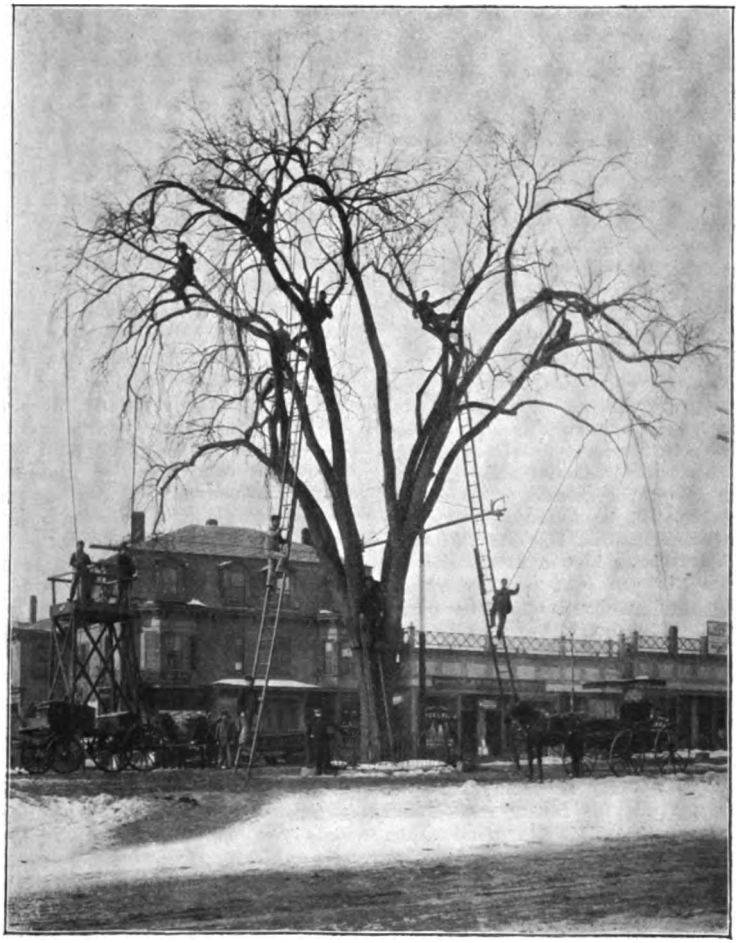

REMOVING BROWN TAIL MOTHS, SOMERVILLE, MASS.

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EDITORIAL COMMENT

Cost of Municipal Laying of Asphalt.

The Transportation Question in the Cement Trade.

Has He Gone to New York.

COST OF MUNICIPAL LAYING OF ASPHALT.

In the December number of Municipal Engineering, page 435, was an estimate by Mr. Proctor of the cost of laying asphalt in a municipal plant, which computed the actual cost of laying asphalt at 67 cents, including three items, topping at 44 cents, binder at 20 cents and maintenance at 3 cents. The maintenance charge is for maintenance of plant, not of pavement, and includes interest, depreciation, repairs and insurance, rent, and taxes.

Mr. Raymond, in an article elsewhere in this number, points out the fact that these estimates assume constant employment, or, rather, no expense for plant or labor when work is not in progress, and justly claims that this asumption is without sufficient basis.

In the November number of Municipal Engineering will be found some figures from the municipal asphalt plant at Winnipeg, Manitoba, which clearly show the difference between cost with this assumption and under everyday working conditions. The figures for cost of materials are larger than those given by either Mr. Proctor or Mr. Raymond, and the final assessments against property owners show how much they must be increased that the city may come out even.

Mr. Proctor thinks 67 cents is enough to allow for cost of laying binder and top, as stated above. Mr. Raymond thinks this might be all right for constant work, but that the actual cost with due allowance for lost time and labor and without allowance for profit would be more than $1. The authorities at Winnipeg, in computing the assessments to be made against property owners for asphalt pavements laid assign to the items included in the figures of the two gentlemen, named the following cost prices:

Binder, 1½ inches, at plant	.18½
Binder labor on street	.08
Surface, 1¾ inches, at plant	.45
Surface labor on street, teaming, etc.	.15
Plant charges	.05
Other charges	.03
Making a total of	.94½

The charge for labor is undoubtedly very high for continuous work, and shows the great allowance that must be made for lost time.

It is evident from these figures that Mr. Raymond's plea for careful investigation and for full consideration of all the circumstances has a good basis. Detroit has been paying from $1.12 to $1.23 for surface repairs, according to Mr. Proctor, and he estimates that, with a cost of 67 cents in a municipal plant the city would save over $50,000 a year with the amount of work done the past year. Evidently, were the asphalt laying the straight work of laying new pavement which was done in Winnipeg, the cost will be nearly 50 per cent. more and the saving consequently nearly cut in two. This cuts down the profit which the contractor is making under present conditions very materially. But, as Mr. Raymond points out, the cost of repairing is much greater than the cost of laying new pavement, so far as the labor item is concerned, at least. This is evident from a consideration of the facts that the patch must be cleaned out, the old material removed, a good surface for junction with the new material formed and a tar coat applied, all in addition to anything required in laying new pavement; also that the patches are more or less scattered, and there is loss of time in moving men and machinery from one patch to another and in unloading material. The labor on the street, according to the Winnipeg experience, costs 23 cents a square yard. An increase in labor cost of 50 per cent. is perhaps not excessive, which would increase the total cost of laying repairs per square yard by 11½ cents, making it $1.06. With Detroit prices this leaves only 6 to 17 cents a yard, or 5½ to 16 per cent. for the contractors' contingent fund and his profits. This does not seem to be exorbitant.

A report of the New York Commissioner of Public Works made in November, 1903, on the subject of a repair plant for asphalt pavements for the Borough of Manhattan contains an estimate by Dr. J. C. Bayles of the cost of repair materials and labor as follows per square yard of pavement:

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Asphalt cement	.30
Sand, stone, oil, etc.	.15
Mixing, carting and laying	.35
Total	.80

The items do not agree very closely with those in either Winnipeg or Detroit or as given by Mr. Raymond, partly because the form of the pavement is different, but, when plant charges and general supervision are added, the total will approximate that given for Winnipeg. The present contract rates for repairs in Manhattan are for binder, $1.52, and for wearing surface, 45 cents a square yard.

The contractor may have one advantage over the city in being able to obtain asphalt at a lower price than that paid by Winnipeg, but this is a question quite aside from that under consideration and does not change the fact that the city must pay the prices named.

Facts are sometimes hard things for theories to overcome, and it is not safe for a city to enter the asphalt paving and repair field without more careful consideration of all the conditions than seems to be shown in the Detroit report under discussion.

Such portable apparatus as is now offered for small repairs of asphalt streets and for putting them in shape before the actual time for repair arrives, do not come properly into this consideration, as they have their own place, and can often be used profitably by city or contractor when there is a regular contract for repairs of the customary nature, making certain classes of repair more economically than they can be done with the ordinary asphalt plant.

THE TRANSPORTATION QUESTION IN THE CEMENT TRADE.

The third edition of the "Directory of American Cement Industries" is now in active preparation for issue early in 1904. It shows a vast increase in capacity for production of cement during the year, and an almost equal increase in consumption. The demand would, apparently, have exceeded the supply throughout the year as it did early in the season, if strikes and financial flurries, especially the former, had not curtailed building operations.

The cement factories are now so widely distributed that the question of freight rates is becoming one of great importance. This condition was recognized three years ago or so by some of the larger companies, and their extensions to keep up with their rapidly growing trade have been made in the form of new mills located in new regions. Factories of Pennsylvania companies are now located in Ohio, Indiana and Missouri, as well as in the home state, and there is at least one group of capitalists who are establishing works in various parts of the United States and Canada, independent in form, but under the same financial control.

A controlling reason for this tendency is found in such facts as the following: Some bids for work were called for and cement prices clustered about $2.05 to $2.10. One contractor proposed to a nearby factory to purchase at the factory for the same price that he was offered for equally good cement at a distant factory. For illustration we will take the freight rate from the Lehigh region to Cincinnati, 15 cents a hundred pounds, and from Michigan points, 7 cents. The difference, about 30 cents a barrel, is a very satisfactory increase of the contractor's profits. When cement stocks are large and money is wanted by the manufacturers, contractors can pick up numerous bargains of this sort.

Cement has been quoted in New York at about 90 cents in large lots, and there has been nearly the same condition in Chicago when there was any large business to do. But in San Francisco cement in car load lots will bring about $1.75. An exaggerated case is found in the bids for cement for the Touto basin dam in Arizona, where the price of cement was $9 a barrel, due largely to the long railroad and wagon haul. This is an exceptional case and the government engineers have determined that a large sum of money can be saved by building a Portland cement plant on the ground for the sole purpose of making the cement for this structure. As shown more in detail in another department of this number of Municipal Engineering, bids will now be asked for cement delivered on the ground and for cement made on the spot by the machinery already purchased.

Though an exaggerated case, this demonstrates the theory that the location of new cement plants must be based largely on the matter of freight rates, assuming a local demand, actual or prospective, and proper materials.

The enormous fluctuations in price of cement recently are due largely to the inability of the mills to supply the legitimate demand for cement, as detailed in this department in the November number, but when temporary checks to building operations fill up the stock

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houses, the anomalies of freight charges and the resulting competition of local factories with over-loaded factories in other districts exaggerate the variations and result in such peculiar conditions as a factory shipping all the cement it can make at a price which would indicate a complete stagnation of the trade.

While it is necessary to shut down factories for repairs, any long continued stoppage of all factories would put them next season in the same condition they were the past season, unable to fill orders and helping to bring on a stagnation in business by restricting building operations or necessitating substitution of other materials. When the cement plants are able to fill the regular demand, and are better distributed, cement rates will reach a state of comparative uniformity, if not artificially manipulated, but in the meantime, such pronounced action as seems to be contemplated by the large manufacturers, as detailed elsewhere, will only exaggerate the unfortunate conditions under which we are laboring in the present stage of development of the industry.

That many persons have confidence in the reality of a demand for cement next season in excess of the supply, especially if the mills are shut down for a large part of the winter, is indicated by the fact that money is being borrowed with which to invest in cement at present prices, with the expectation of making large profits next season, notwithstanding extra freight and storage charges.

A comparison of capacity and demand will be attempted in an early number of this magazine based on the data gathered for the new edition of the "Directory of American Cement Industries."

HAS HE GONE TO NEW YORK?

Our readers of some years' standing may remember the methods of certain journals in Louisville and later in Cincinnati in working up their circulation. They purported to be industrial papers circulating in the South and asked for approval of laudatory articles concerning men or machinery, and proposed to sell copies of the number containing the notice.

A notice recently received by a reader of this magazine from the "Financial Review" of New York City suggests the possibility that the same writer has removed to that city. The notice is as follows:

For those who are interested in the matter of municipal reform, in the beautifying of our large cities from an artistic standpoint and, in fact, the promotion of better government in all departments, parks included, the recent convention of the American Society of Municipal Improvement, which was held in Indianapolis, will no doubt have an interest, for this association has proved useful in the past and has a bright future. The election of Mr. —— of ——— as ——— has been commented upon from different standpoints naturally enough, but in no case has the comment been of an unfavorable character. His own work in an official way has been not only competent but has afforded evidence that he is heart and soul in favor of anything calculated to promote improvement in his own city. Mr. —— has a host of friends both in and outside of the organization referred to and in —— so his election was logical. As a man of affairs, also, he stands high in the business world.

A slip in the name of the city shows that the notice is sent to all the officers of the society in the same wording. There must be a monotony in the columns of the paper which would discourage the placing of a $5 subscription, if a sample copy could be seen before making the reply which the following letter, accompanying the notice, is intended to bring:

We inclose an item which, with your permission, will appear in our next issue. We would like to receive your subscription, in which event we would send you twenty copies gratis. Trusting we shall hear from you we remain.

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THE QUESTION DEPARTMENT

PLASTERING ON HOLLOW CONCRETE BLOCKS.

I have a house nearly finished with hollow concrete blocks. It is a good looking house and many admire it. I would like to know if we can plaster on the blocks or will it be better to lath against the blocks. Some think the blocks will sweat and color the paper.

R. B. CLEMENT,
Walkerton, Ont.

One of the points made by the advocates of hollow cement block construction is that the plastering 'for the inside of the house can be applied directly to the blocks without any studding and lath. The hollow wall is expected to keep the inside surface dry and warm. The joints must be well filled and the proper junctions made according to the designs of the blocks. Most of the blocks break the joints so that moisture will find it very difficult to follow them through to the inner wall surface, and some go so far as to put joints only half way through the wall, the blocks being made so as to overlap. Any of the methods in common use promise success in keeping the inner wall surface dry.

The blocks should be thoroughly set and dried before the plaster is put on, otherwise there might be a slight absorption by the plaster of any free water used in the construction or absorbed from exposure, with a consequent discoloration. This can be entirely prevented by proper curing of the blocks and drying of the walls before plastering.

ABOUT CEMENT SIDEWALKS.

Do you know of a good form for specifications to lay cement sidewalks? Can you give me approximate cost per square yard to lay cement walk, grading done by owner? Can you give me any other facts as to cement sidewalks?

J. DICKINSON CONDICT,
Madison, N. J.

The "Handbook for Cement Users" ($3) square foot to 20 cents or so, according to specifications, cost of cement, kind and cost of other materials, labor conditions, difficulty of work, etc.

CEMENT CHEMISTS AND ENGINEERS.

I have some rock which I would like to have analyzed for cement and would like to be referred to some one who can do the work. Please also refer me to some one as to the cost of a cement plant and cement machinery.

One rock is a black porous lava, of which there is a large solid body on the railroad, with side tracks, water and fuel accessible. It is being used for concrete, fire-proofing and some kinds of ornamental work. Tests have been made on it for slag cement with favorable results. Another rock is a gray volcanic tufa, also on the railroad, with water and fuel.

G. R., Los Angeles, Cal.

Who can furnish estimates on cement plants?

W. C. B., Toronto, Ont.

Reference should be made to the "Business Directory" in the advertising department of Municipal Engineering, under the heading of "Cement Plant Designers;" also to the list of "Engineers Who Design Cement Plants" in the "Directory of American Cement Industries" ($5).

With reference to the first questions it might be said that similar materials have been used with fair success since the days of the ancient Romans, and are now in use at San Giovanni a Teduccio, near Naples, Italy. The questions of quality of product, cheapness of freight on raw materials and supplies and proximity and size of market for the cement are matters which must be specially considered, even if the chemists' reports concerning the value of the material are favorable. Uniformity in composition of the raw materials and proximity of any corrective material which may be necessary to produce the best cement are also essential

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PLANS FOR CONCRETE CULVERTS—WHERE TO PURCHASE STEEL BEAMS.

1. Where can we get plans and specifications for concrete culverts and bridges?

2. Where can we get iron and steel I-beams by the carload?

K. & CO., Tecumseh, Neb.

The best place to get specifications for concrete culverts and bridges is in the "Handbook for Cement Users" ($3). Valuable information will also be found in the back numbers of Municipal Engineering. Plans should be prepared by an engineer of experience in this class of work who can have an opportunity to make himself familiar with the local conditions which must be met, such as span, foundation, protection from flood, possibility of settlement, possible loadings, etc. Reference may be made to the "Business Directory" in our advertising pages under the headings "Civil Engineers" and "Bridges." Lists of names of Engineers using concrete will also be found in the "Directory of American Cement Industries" ($5).

2, The nearest manufacturer of structural steel is probably the Colorado Fuel and Iron Company, Denver, Colo. Other makers are the Cambria Steel Company, Chicago office, 138 Jackson Boulevard; Carnegie Steel Company, Chicago office 204 Dearborn-st.; Illinois Steel Company, The Rookery, Chicago.

CEMENT REQUIRED FOR WET CONCRETE.

Being an appreciative subscriber of your magazine I would be pleased to have you answer the following question, as from the data at hand I cannot figure it out. We are now making what is called dry concrete and tamping it, and the molds that we are using make it rather difficult to tamp without expending much time. We do not care about the outside finish, i. e., we do not care whether it looks like cut stone or not. We are using one part Portland cement, two parts sand and four and one-half parts gravel passing a three-fourth-inch screen and the sand screened from it. What we want to know is how much more cement we will have to add to have practically the same strength concrete by the wet concrete process, i. e., wet enough so we can pour it into the mold.

F. A. SICKLESTEEL,
North Branch, Mich.

The claim made for wet concrete is that it produces a stone of greater strength with the same proportion of cement. If the mixture is properly made this is probably true, since the stone will be somewhat more dense. The mortar must not be so wet that the heavier stones will settle to the bottom and the water will collect on the top, and still it must be wet enough so that the mixture will flow into all corners and recesses of the mold and leave no vacancies bridged over by the stones wedging together. The mixture must be thoroughly well made before and after the water is added so that the cement will be uniformly distributed through the mass, and in such manner that the water will not wash it out. With care a stronger mixture will result than when the concrete is made with as little water as possible and tamped in the ordinary way, though thoroughly tamped stone is shown by some experiments to be equal if not slightly superior in strength.

It must be remembered that the wet concrete must be left in the molds for several days, two or more, to set, while the dry tamped concrete can be removed immediately if properly handled.

HOW TO MAKE LIGHT-COLORED CEMENT WALKS.

I would like to know what method is adopted to obtain light-colored walks. It there any process by which cement walks can be bleached out white after the troweling and floating is done?

J. H. OTTERSTATTER,
Titusville, Pa.

Each cement has a fairly definite color which cannot be changed. This color does not appear always when the surface is first finished and will usually be somewhat lighter after the cement has fully set and the surplus water has evaporated.

Walks can be whitened in color by using white materials in finishing. The use of marble dust is described in Municipal Engineering, vol. xxv., pp. 250 and 419, the latter article giving specifications for sidewalk construction.

Most persons desire darker walks rather than lighter, but the use of marble or limestone dust of light color will make the color as light as it can be made.

There are no successful processes for whitening cement work after it has been laid.

PATENTS ON HOLLOW CONCRETE BLOCKS.

Can you inform me as to whether there is any patent now pending or in force upon the manufacture of hollow concrete blocks for building or upon the manufacture of the molds?

F. A. V., Ellsworth, Kas.

The subject of patents on hollow concrete blocks was quite fully discussed

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in Municipal Engineering, vol. xxiv, p. 436, and a list of the earlier patents on blocks of various forms and for various purposes is there given.

There are also a number of patents on machines for making the blocks.

Among the articles in Municipal Engineering describing blocks, machines for making them and processes, the following may be mentioned, some of them containing references to the patents covering the apparatus, process or product:

"Concrete Building Blocks," vol. xxii, pp. 13, 161, 163. xxiii, p. 392.

"H. S. Palmer's Method of Concrete Building," vol. xxiii, p. 482.

"Machines and Methods for Making Hollow Building Blocks," vol. xxiv, p. 191, describing the machines and processes patented by H. S. Palmer, N. F. Palmer, the Cement Machinery Company (Normandin), Seamans, Stevens, and the Standard Stone Company.

The Seamans machine is described in vol. xxiv. pp. 234, 393, and vol. xxv, p. 375, with patent specifications.

Some information regarding suits on patents will be found in vol. xxiv, p. 393, 453.

The blocks of the American Hydraulic Stone Company are described in vol. xxiv, p. 457.

The Miracle pressed concrete block machine is described in vol. xxv., p. 53.

The Normandin machine is described in vol. xxv, p. 54.

The Winget machine and block are described in vol. xxv, pp. 129, 390.

Dykema's molds and their product are described in vol. xxv, p. 464.

Reference may be made also to our advertising columns, as the prominent makers of machines and blocks are represented there. Fisher's hydraulic stone system is one of the latest.

New patents are issued at frequent intervals and if watch is kept on the list of "Recent Inventions" in the department of "Machinery and Trade," in Municipal Engineering each month, the general character of these patents and their numbers and claimants can be learned.

SILEXOID PORTLAND CEMENT.

Can you tell me what is Silexoid Portland cement, which is on the market, and who makes it?

J. D., Kankakee, Ill.

The Silexoid Portland Cement Company is a corporation whose main office is at Union City, Mich. It succeeds the Calumet Portland Cement Company and has its works at Thirty-ninth-st. and Lowe-ave., Chicago, Ill., where it makes its "Improved Portland" cement by grinding up together Portland cement and crushed limestone exceedingly fine. It is thus similar to silica Portland cement, which shows excellent qualities, substituting, however, limestone for sand in the mixture. Tests of the cement are not at hand, but it is probable that they show high results, especially when the cement is tested neat. Neither is any information at hand regarding its durability in various kinds of construction.

CONCRETE FLOOR FOR ENGINE HOUSE.

We would like to know if a board floor two inches thick could be covered with expanded metal or wire netting and a coating of cement two inches thick, made of 2 parts sand and 1 part cement, placed on this metal would make a good job. Would it be sufficiently strong for a floor in a fire engine house which is not used a great deal? We presume that the floor is solid to start with.

ILIFF BROTHERS, Cedarville, O.

This question cannot be answered definitely without a personal knowledge of the present floor and its supports, but it is almost certain that the present floor is not strong enough to carry the weight of the cement floor in addition to its present load, and unless the concrete floor is well anchored to the foundations on all sides, and these are strong enough to stand the strain, a failure of the present floor would result in a failure of the concrete floor. Such a floor as that proposed is sufficient if the supports and the anchorage to supports and walls are sufficient, but its construction should not be attempted without full directions from a competent architect or engineer with experience in concrete construction.

MOLD FOR MAKING CEMENT PIPE.

I will thank you if you will give me the address of the American representative of the German Kielberg press for making cement pipe, mentioned on page 425 of the December number. In the same article you refer to the abandonment of a plant in Brooklyn using the Sherman machine. Will you kindly tell me whether this abandonment was caused by a failure in introducing the article or was the machine a failure?

W. C. HUMPHREYS,
Norfolk, Va.

The address of H. Schebye, C. E., is 348 Carolina-st., Pittsburg, Pa., and his advertisement of the Kielberg molding press for making pipes will be found in our advertising pages.

There does not seem to have been any

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great effort to introduce the Sherman machine. Reports indicate that it was used in making cement sewer pipe for use in Brooklyn, but that no machines have been used elsewhere, and now the use of cement pipe has been practically abandoned in Brooklyn. There seems to be no special reason for all this, although there were occasional complaints some years ago, when the methods of manufacture were less fully understood, of deterioration of cement sewer pipes in use. It cannot be said that the reported abandonment of the Brooklyn machine was due to defects in the machine, and it would not be proper to condemn sewer pipe made with the better knowledge of mixtures and methods of treating them of the present time on account of rather indefinite statements of occasional failures o'f pipe many years ago.

Some description of the Kielberg machine will be found in the department of "Machinery and Trade" in this number.

OF INTEREST TO CEMENT BLOCK MANUFACTURERS.

Kindly advise me if there are any back numbers of Municipal Engineering that would be of particular interest to cement block manufacturers.

F. T. C.,
Ft. Dodge, Ia.

Reference should be made to the article in this department under the heading "Concrete Block Machines" for a full list of articles upon cement blocks. There are doubtless many more articles of interest to makers of such blocks among the many upon cement and concrete in the successive numbers of the magazine.

LIST OF CEMENT MANUFACTURERS.

Kindly send me that copy of your magazine which embraces the list of cement mills in the United States, with their output, etc. Also if you know of any corrections to be made to the list which you can make easily, I should be glad to have you advise me what they are. Also I should like to know when you expect to publish a new, revised and up-to date list.

E. D. KIMBALL,
Wichita, Kas.

The best list in print, giving all the information asked for above and much more, is to be found in the "Directory of American Cement Industries and Handbook for Cement Users" ($5). A list of new companies, since the last issue of the Directory, in operation and under construction, will be found in Municipal Engineering for October, 1903, vol. xxv, p. 261.

The third edition of the "Directory of American Cement Industries" is now in active preparation for issue early in 1904 and will have the latest revised list of cement manufacturers, giving officers, capitalization, capacity, brands, sales agents and descriptions of works, besides much other information and other directory lists as is set forth more in detail elsewhere in this number in an article describing the book.

QUALITY OF CEMENT—CONCRETE BLOCK HOUSES.

Mr. R. B. Clement of Walkerton, Ont., in writing about accidental wetting of cement, as reported in Municipal Engineering, vol xxv, p. 372, says he has "no doubt it was good cement and if it had got plenty of water on it for two or three days it would have stood hard pounding." He has had similar experience. He continues as follows: "I am delighted with the last number of Municipal Engineering and think that all cement contractors should tell you the worth of it in their business."

Mr. Clement has just completed a hollow block concrete house doing the work himself with the help of a man at $1.25 a day, while masons receive $3 a day. The man alone laid three chimneys in one day at a saving of $50 over brick chimneys. The house cost about the same as brick, owing to the high price of cement when the blocks were made. With low prices for cement, such as those this winter, he can build cheaper than with either brick or wood, and give better satisfaction. The blocks are rock face. The cellar is successfully grouted with 1 part sand to 10 parts of sand and gravel.

AMOUNT OF LIME REQUIRED IN BUILDING.

Our water company makes a charge of three cents a bushel of lime for building purposes and I would like to know if you have any books that would be of assistance in figuring the number of bushels required in any building.

WILLIAM L. GIBB,
Ocean City, N. J.

Perhaps some of our readers can give rules which they have found convenient. It would be interesting to know the origin of such peculiar rates as this. Trautwine's "Engineers' Pocketbook" ($5) contains the data desired. It would apparently be simplest to require presentation of the bills for the materials actually furnished. In the absence of this definite information an estimate of the number of bricks must be made. Trautwine gives the number of standard size re-

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quired per square foot of wall of different thicknesses, from which the total number of bricks can be obtained if the number of square feet of wall of each thickness is obtained from the plans of the building. He also gives the quantity of mortar required per thousand brick with various thicknesses of joints and allowance for waste, and the quantity of lime required for this mortar. There are evidently many chances for inaccuracy in these computations so that the result can be considered as only roughly approximate.

WATER-TIGHT RESERVOIRS.

With reference to water-tight reservoirs J. E. Salfisberg & Co. of Aurora, Ill., report their experience in withstanding water pressure from without. The bottom of the basin was about two feet below the river level and about thirty feet from the river bank. In construction they were bothered considerably with the permeation of water from the river and from springs underneath the basin. An 8-inch concrete floor was put in, but it heaved up in the center and 10 inches more of concrete was added to make it safe. In response to their inquiry the address of the Thayer School of Engineering is given as Dartmouth College, Hanover, N. H.

DEDUCTIONS FROM HYDRANT RENTAL FOR LACK OF PRESSURE.

A city claims to have the right to deduct from the hydrant rental a certain amount on account of the water company in case of a fire not having pressure enough to give the fire company ample water for fire protection. If you know of any cases of the above description will you refer me to the decisions?

JUDD DECKER,
Superintendent of Water Works, Sterling, Ill.

Leaving out of consideration any contract provisions which might settle the matter, the following decisions among the many which have been rendered may be referred to. Those regarding damages for fire loss on account of lack of water pressure are given as throwing a side light upon the question asked.

A contract requiring the water company to repair pipe within forty-eight hours or town will not be liable for water rents and company will be liable for individual losses caused by the condition of the pipes is not a bar to all recovery as for a breach of contract, because of occasional bursting of pipes, Grand Junction Water Company vs. City of Grand Junction, Colorado. Vol. 60, Pacific Reporter, page 196.

A water company which unconditionally contracts to supply a consumer with water and fire pressure is liable for damages for failure of fire pressure, even though the break in pipes is not the water company's fault. Knappman Whiting Co. vs. Middlesex Water Co. Vol. 45 Atlantic Reporter (N. J.), page 692.

Pleas of insufficient pressure are insufficient as complete defense to a suit for hydrant rentals, and demurrers thereto are properly sustained. Greenville, Ala., vs. Greenville Water Works Co. Southern Reporter, May 30, 1900.

A contract to furnish an ample supply of water is severable and the borough is liable for the actual service rendered in good faith under such contract, though at times the supply was inadequate. Hyndman Water Company vs. Borough of Hyndman, Pa. Vol. 7, Pennsylvania Superior Court, page 191.

Where a water company has contracted to supply fire protection in quantity and force, a failure will entitle the city to treat the contract as terminated even though no actual damage occurred. Light, Heat and Power Company of Jackson vs. City of Jackson, Miss. Vol. 19. Southern Reporter, p. 771.

A contract for fire protection between a city and a water company does not give a water consumer a right to damages from the company for fire loss due to failure of water supply in quantity or presure. Akron Water Company vs. Brownless, Am. Dig. August, 1895. Also House vs. Houston Water Works Company (Tex.). Am. Dig. June, 1895. Also Buch vs. Artesian Hot and Cold Water Company, Idaho. Am. Dig. January, 1896; and Miss. Supreme Court, Dec. 4, 1900. See Municipal Engineering, vol. xx, p. 39.

A city is liable to a patron of the city's public water works for loss by fire on account of negligence in permitting system to get out of repair. Lenzen vs. New Braunfels, Tex. 35 S. W. Rep. 341.

On the contrary, neither water company nor city owning water works is liable for damages of consumer by fire, according to Eaton vs. Fairbury (Neb.) Water Works Company, 56 N. W. Rep., 201 and Municipal Engineering, vol. vi, p. 171. Also, a citizen cannot recover from the city for fire loss, the fire pressure and supply being defective, according to Butterworth vs. City of Henrietta, Tex., 61 S. W. Rep., p. 975, and Municipal Engineering, vol. xx, 352.

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Ukiah, California, obtained a judgment in a jury trial against the Ukiah Water and Improvement Company in 1890 for $570 fire damages to city property on account of defective water supply. Municipal Engineering, vol. xix, p. 418.

With the exception of the contradiction in Texas, in which the court seems to have reversed itself, the general tendency of the decisions is to reduce the responsibility of the water company for failure to supply fire service to the actual duration of the defective service, the company being able to collect for all service actually rendered in good faith, though it did fail at critical times, and to take off all liability for damages for actual fire loss on account of such failures.

BOOKS ON IRRIGATION.

What is the best work on irrigation and where can I secure it?

SUBSCRIBER, Havre, Mont.

The best book upon the technical features of irrigation engineering is Wilson's "Irrigation Engineering" ($4), the fourth edition of which has just been issued, revised and enlarged. Newell's "Irrigation" ($2), is a discussion of the subject from the economic standpoint and also contains much which is of direct value to the engineer. Mead's "Irrigation Institutions" ($1.25), is a valuable treatise upon the legal aspects of irrigation questions showing the need of some central authority in state or nation.

A review of Mead's book will be found in Municipal Engineering, vol. xxv, p. 270 and one of Newell's book in vol. xxiii. p. 294. A review of Wilson's book will appear later.

OWNERSHIP OF OLD MATERIALS DISPLACED BY NEW CONSTRUCTION.

I am the contractor for a "court" ditch in the town of Boswell. It is a common tile drain on the line of an old county ditch and I am lifting the old tile. Do they belong to me or to the town or to the people who paid for them when they were laid? There is about a hundred rods of the old 12-inch tile. The contract says nothing about the old tile. Boswell is an incorporated town.

The line goes under the railroad track. Can the railroad company make me furnish anything but the common drain tile that the plans call for?

B. F. DIMMICK, Boswell, Ind.

Detailed answer to these questions can only be made by an attorney who has carefully examined the provisions of the contract and knows the law governing this kind of work. A few general observations may not be out of place, however. If Boswell is an incorporated town the old materials would belong to the town in case nothing was said about them in the contract. The contractor is probably to some extra expense in removing them, which should be a claim against them, partly offsetting their value. If the contract is with a drainage district, the old materials would probably be considered as belonging to the district. They could probably not be claimed by individuals who paid the assessments levied for the construction of the old drain. In that case their value to the contractor after removal, due allowance being made for their condition and the extra expense of removal, might well be made a charge against the contractor, or they might be sold and the money turned in to reduce the assessment for the new drain. The attorney could give the legal steps necessary.

The railroad company probably has the right to prescribe the kind of construction which it will require under its tracks and right-of-way, provided it does not affect the main purpose of the drain. Unless the matter of extra expense in crossing the right-of-way is settled on the contractor by some provision of the contract, this extra work and extra expense for different material would probably be chargeable to the drainage district or the town as an extra, over and above the contract price. The railroad doubtless pays an assesment for the drain, but this would be independent of the question of the cost of making the crossing. Some roads insist upon doing the work on their own rights-of-way under their own officials and occasionally by their own men. It may be quite a complicated matter for settlement which would require direct assistance from the legal profession.

MAKERS OF AND DEALERS IN CAST IRON WATER PIPE AND SPECIALS.

Will you kindly give me the names and addresses of some cast iron water pipe and casting makers in Chicago, St. Paul and other middle west points?

W. N., Windsor, Ont.

There is but little cast iron pipe manufactured in the district named. The following firms have offices in Chicago, viz.: James B. Clow & Sons and the U. S. Cast Iron Pipe and Foundry Company, 217 La Salle-st., the latter having foundries located in many places.

William B. Scaife & Sons, Pittsburg.

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Pa., make riveted steel pipe as shown by their advertisement in this magazine.

The American Car and Foundry Company has offices at 706 Chestnut-st., St. Louis, Mo., and the Colorado Fuel and Iron Company, Denver, Colo, makes pipe from three to twenty-four inches in diameter.

Nearly all the pipe foundries are located south and east of Ohio.

INFORMATION ON DREDGES.

Is there any book on the use of dredges in cutting drainage ditches?

H. G. P., Moline, Ill.

There seems to be no book on the market discussing this subject. The only sources of information open are the engineering and drainage publications and the proceedings of societies. The old "Drainage Journal," now combined with the "Clayworker" at Indianapolis, Ind., has in its back numbers some interesting information upon this particular class of dredging.

Can our readers refer us to publications on this subject, either books or periodicals?

ASSESSMENTS FOR SIDEWALKS AT STREET INTERSECTIONS.

Will you inform me as to general practice in assessing cost of sidewalk construction at street intersections? Is it customary to charge corner lots with that part of the sidewalk extending from the property line to the cross-walk or crossing? For instance, a street is 80 feet in width and divided as follows: A 9-foot grass plat next to property line, a 6-foot sidewalk and an 8-foot grass plat between walk and curb, with 34-foot roadway. This plan requires 40 feet of walk at each corner. Should this be a charge against corner lots or apportioned to all lots within the block or borne by the city as a general expense? Cases of this kind sometimes arise when all lots within the block affected have previously constructed the walk abutting their property, excepting the corners.

S., Havre, Mont.

The older custom is for the sidewalks to be considered practically the private property of the property-owner, and in Where the town exercises a little control over the kind and cost of sidewalks, largely by sufferance, it is most likely to pay the expense of these extensions.

Many cities pay a share of the cost to induce property owners to put down a better class of walks. Thus the northern cities which are desirous of displacing the old wooden sidewalks wtih cement or brick offer to pay out of the city treasury a certain proportion of the cost of the better walk, which may or may not make it cost less than the plank walk. In such cases the city's contribution is likely to be considered payment in full of its share and the remainder of the cost is assessed in the way in vogue in the city, though, even here, if the cost of the better walk is greater to the property owners than that of the cheap one the city may pay for these excess walks at the street intersections.

It is hardly equitable to require the corner lot to pay the cost of the forty feet of walk referred to, and in case the private ownership idea prevails, this part of the walk might well be considered the property of the city and be paid for as such out of the city treasury. This is perhaps the most satisfactory method under such conditions.

The most modern idea, however, and that which gives the most satisfaction when it is once in vogue, is to consider sidewalk improvements as upon exactly the same basis as street improvements. In that case the sidewalks at the intersections of streets would be paid for in the same way that pavement of the roadways of the intersections is paid for. In Indiana cities, for example, where the property owners pay all the cost of the pavements, the cost of the entire sidewalk would be assessed against the aggregate frontage and the cost of the intersections would thus be distributed over the entire frontage on the walk. In case some walks are already constructed, the cost of the intersections may be computed separately and property not coming under the assessment for walk abutting it would receive a small assessment for these intersections. In another class of cities, where the city can or must pay a

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LIMESTONE IN A CORD—GRASS IN GUTTERS.

Will you kindly inform me as to the number of pounds of limestone that it takes to make a cord? Also the best way to prevent grass from growing through cobblestone gutters.

FRED T. WILLIAMS,
City Engineer, Petoskey, Mich.

A cord of stone is presumably the same as a cord of wood, 4 by 4 by 8 feet, or 128 cubic feet. If the limestone, quarried in irregular fragments, is piled in cord form 1 cubic yard of the solid stone in the quarry will make about 1¾ cubic yards in the pile, according to Trautwine, and the pile will weigh 96 pounds per cubic foot, as against 168 pounds for the solid rock. This would make a piled cord of limestone weigh 128x96, or 12,288 pounds.

The only way known to the writer to keep the grass permanently out of the cobblestone gutters is to fill the spaces between them completely. This can be done by laying them in a bed of concrete or mortar, or if they are already laid, by cleaning out the joints and filling them with Portland cement mortar. Perhaps some of our readers will report their experience.

CITIES PUMPING SEWAGE.

Mr. N. S. Frost, City Engineer of Petaluma, Cal., makes the following addition to our information about cities which are obliged to pump their sewage:

In reply to your inquiry on page 178 of the September Number of your magazine, in regard to cities that have sewer pumping plants, I would say that Santa Cruz, Cal. (population in 1900, 5,659) pumps nearly all its sewage over a bluff into the Pacific Ocean. I do not think it possible to ascertain the cost, as the same power is used for pumping and to run the lights and whatever may be the system now, at the time I was City Engineer, (during the early 90s.) no separate accounts were kept. I know that the cost of operating the station was considerable.

The main portion of the town lies in a basin, and the only outlet to the ocean is at the foot of the Main street, too close to the bathing beach to permit the discharge of sewage. The sewage of that portion of the town is collected in a reservoir and pumped over the bluff, at a point where the current carries it away. The lift from the bottom of the reservoir is about sixty feet. No storm water or roof water is allowed to enter the sewers, but the last thousand feet or so of the pipe runs through a swamp and the leakage through defective joints adds a great deal to the quantity to be pumped, and of course to the expense.

The city of San Rafael, Cal. (population 3,879) also had at one time a pumping plant, but I believe that they have abandoned it on account of the expense and constructed a gravity outfall in place of it.

PLATES FOR NUMBERING HOUSES.

I am in need of various kinds of number plates for numbering of houses, so that property owners can have a choice of styles, as I have a contract to renumber the city. Please give me the adresses of Manufacturers in stamped and cast metals, nickel plated, etc.

W. F. B. ——, Ga.

Perhaps the Franklin Rolling Mill and Foundry Company of Franklin, Pa., whose advertisement of street signs will be found in our advertising pages, can furnish house numbers also.

If not, the following may be referred to:

Arcade Mfg. Co. brass and aluminum house numbers, Freeport, Ill.

Trevor F. Jones & Co., 874 W. Broadway, New York City.

Nicol & Co., 57 W. Washington, Chicago, Ill.

Enameled Iron Company, Beaver Falls, Pa.

Dayton Stencil Company, Dayton, O.

Wadsworth Engraving Company, Springfield, O.

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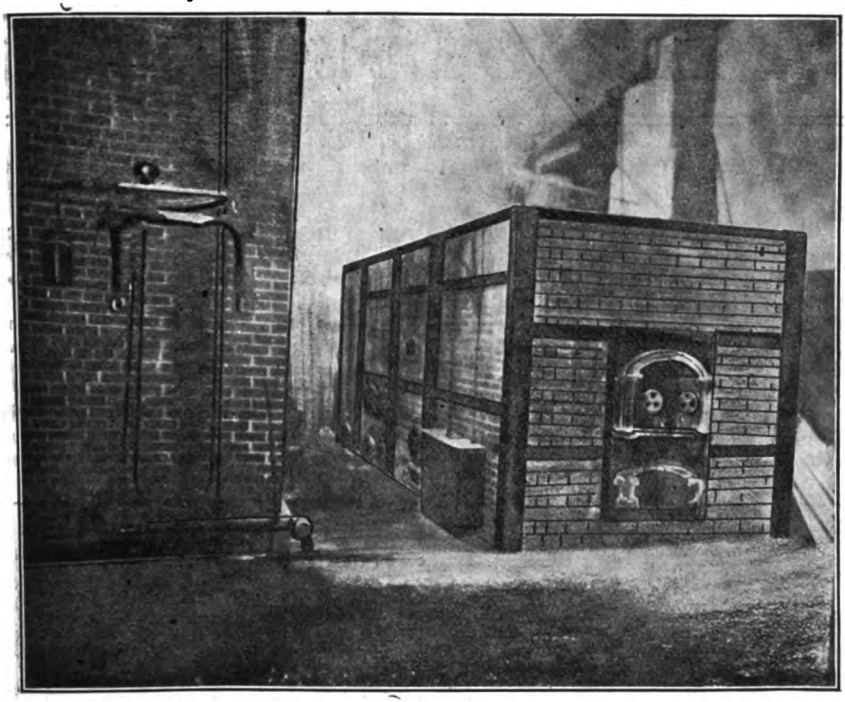
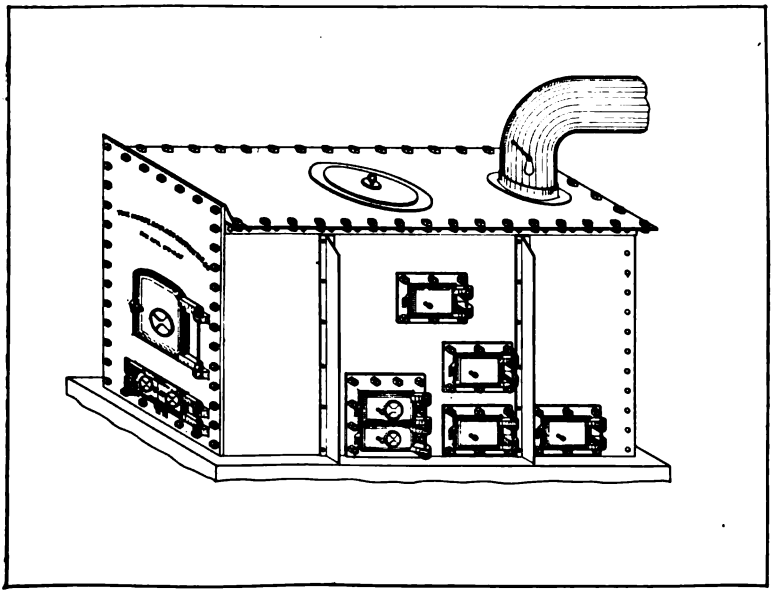


1. MORSE-BOULGER DESTRUCTOR AND GREEN'S ECONOMIZER IN LIT BROS.' DEPARTMENT STORE, PHILADELPHIA.



2. MORSE-BOULGER DESTRUCTOR, STANDARD No. 1.

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GARBAGE DISPOSAL

The Sanitary Disposal of Municipal and Institutional Waste by Cremation.

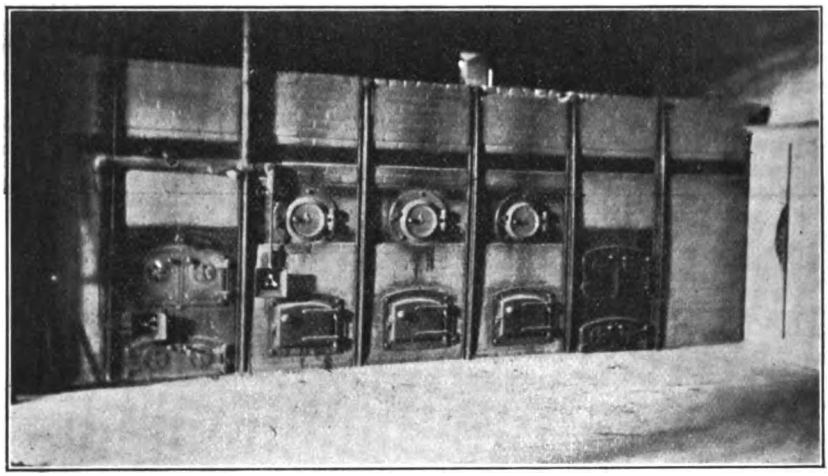
The following selections from a paper by W. F. Morse, sanitary engineer, read at the recent meeting of the American Public Health Association, give a clear statement of the principal reasons for the success in garbage destruction in England and the practical failure in this country.

A review of the work accomplished in the field of disposal of city waste by cremation will show that in three years a number of furnaces have been put in operation which for various reasons have been retired from service, abandoned or suppressed.

It would be a hopeless task to enumerate in detail the various instances of failure, or to explain the causes of the unsatisfactory results that have been attributed. Many of these failures have been due to radical changes in methods of business, in design, material and construction.

Yet not all the skill and experience obtained from years of work in this line has been lost, or allowed to remain unproductive. Distinct advances have been made in the direction of the sanitary destruction of the waste of great business establishments, public and private institutions, and in certain departments of the government.

In the basement of several large department stores have been placed destructor furnaces connected with the upper stories of the building by a chute which carries the waste to a room where it is sorted over by men in charge of the operation of the plant, the valuable portions recovered for market and the remainder used as fuel for the destructor.



3. MORSE-BOULGER DESTRUCTOR,
St. Luke's Hospital, New York City, After Ten Years' Use.

This method of dealing with department stores waste is expeditious, sanitary and inexpensive. The heat produced by the

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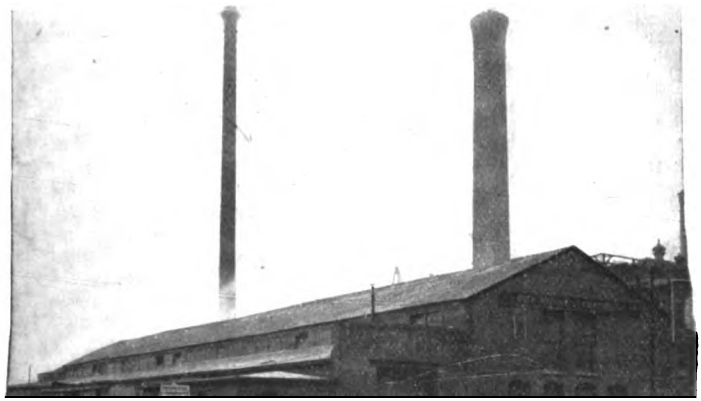
4. MORSE-BOULGER DESTRUCTOR,
Disposal Station Kings County Institutions, Brooklyn.



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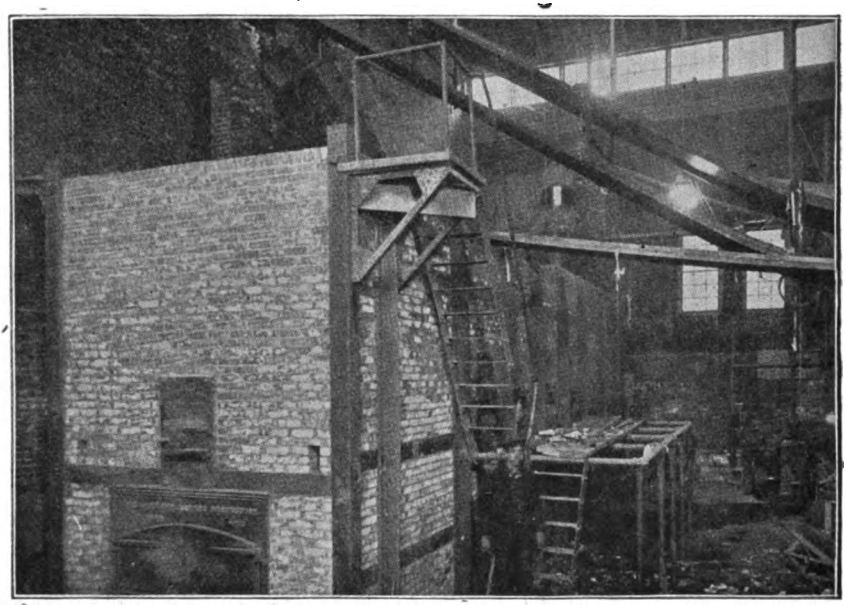
of the establishment. This means a saving of from three to four tons of coal per day during the time that the waste is used. The plan of the destructor is shown more clearly in the perspective drawing, Fig. 2.

In another case the heat from a destructor furnace is introduced under the fire boxes of a boiler of a very large capacity and is used as auxiliary for the production of steam power. Again, in another instance, a steam boiler is attached to the destructor placed in the basement of a large hotel which has a daily capacity of upwards of four tons of garbage.

the employment of destructor furnaces which the experience of four years has shown to be a factor for sanitation and economy in the administration of the municipal government.

This form of disposal of city waste has been carried farther by the installation of a Refuse Utilization station in Boston, views of the exterior and interior of which are shown in Figs. 5 and 6.

The city of Buffalo is about to construct a similar plant which will recover a large proportion of the valuable parts of the city refuse and consume the remainder in a destructor, the heat from which will be utilized to pump the sewage of a large



6. THE MORSE-BOULGER DESTRUCTOR. INTERIOR REFUSE UTILIZATION STATION, BOSTON.

Among the first in the country to recognize the value of destructor furnaces were the sanitariums, hospitals and similar public and private institutions, and for more than twelve years in some of the large cities of the country the waste of hospitals and institutions has been destroyed without unsanitary results and with perfect economy and efficiency. Fig. 3 shows the Morse-Boulger destructor in St. Luke's Hospital, New York City,

section of the city containing nearly 200,000 of the population.

There is no place in the world where the destruction of municipal waste is of more importance than in the tropics, since the rapid decay which seizes upon all rejected animal and vegetable substances requires swift and efficient method of disposal.

When Manila was taken possession of by the American troops it was found that

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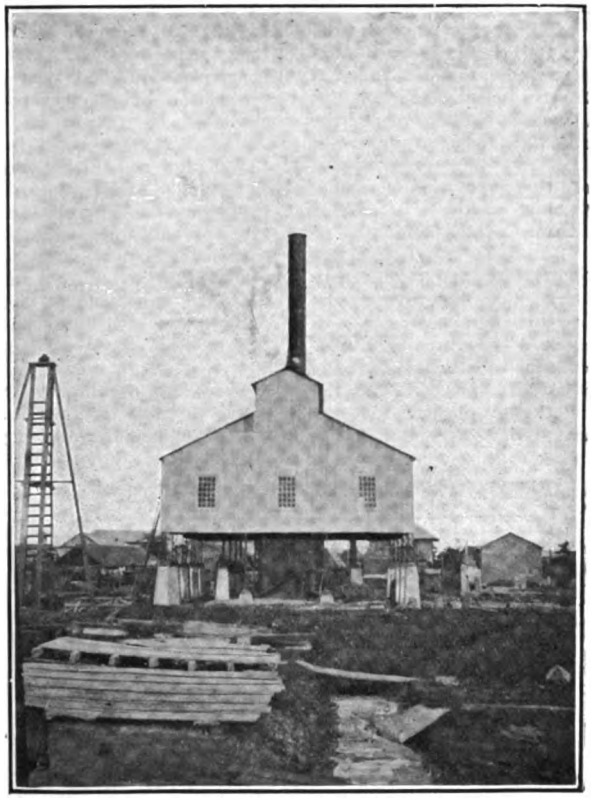
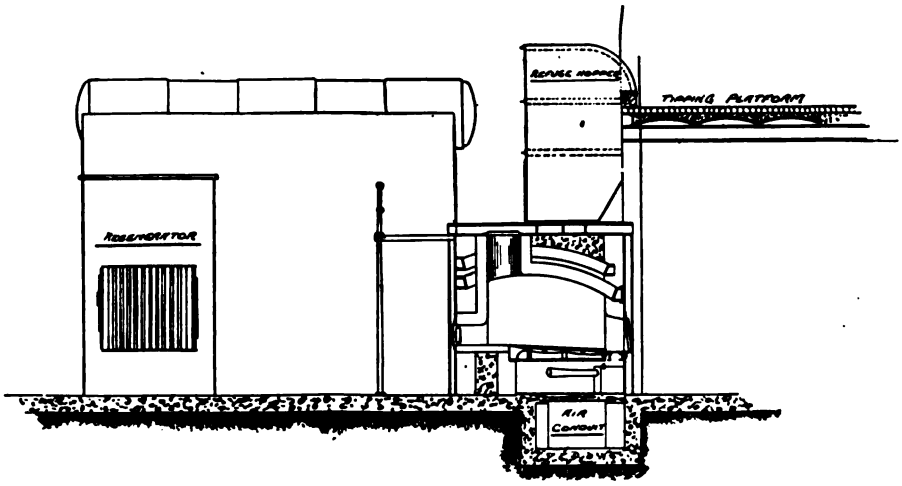


7. THE MORSE-BOULGER DESTRUCTOR AT MANILA, PHILIPPINE ISLANDS.



8. MELDRUM TOP-FEED "SIMPLEX."

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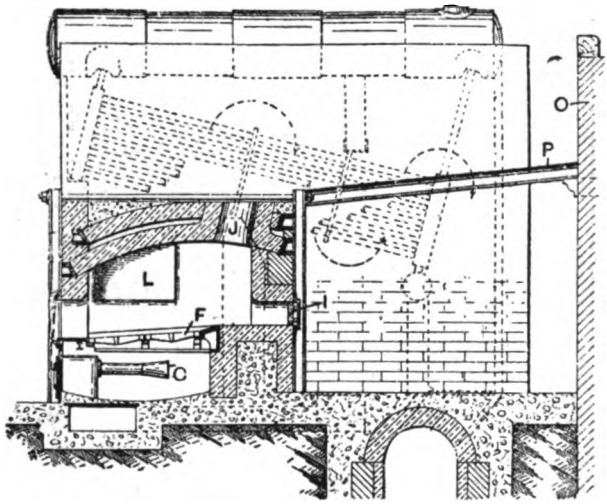
city. It is one of the largest single plants in operation in the United States. Reports from there indicate that there is destroyed by this furnace a larger amount of waste than was stipulated for in the contract, which was to be upwards of 120 tons daily.

The secret of the rapid and complete combustion of this waste is a matter which has heretofore baffled most American crematory builders. When garbage is destroyed in the ordinary American crematory by natural chimney draft the heat rarely rises to a temperature above 800 to 1,000 degrees. The proportion of 40 to 60 degrees of moisture in the garbage delays ignition and combustion, and the use of fuel for the evaporation of this water is necessary. But if combustion is stimulated by forced draft in the ashpit of the fire boxes, and the manipulation and charging of the furnace are so managed as to dry a portion of the garbage for use as fuel, combustion is not only maintained but is raised to a higher temperature than it is possible to attain by natural draft. This is the principle upon

sanitarian, Lord Kelvin, when he said that the waste of any city when properly consumed and the heat applied to the production of electric power, would be sufficient to furnish a light of eight candle power for every individual in the city during the three hours when light is necessary. At the time when this statement was made it appeared to present a fanciful and impossible idea, but it has been more than realized by the results of practical work. Within four or five years there has developed in England a class of destructor which will consume every kind of municipal waste without nuisance, will developed steam power in the proportion of one and one-half to two pounds of water evaporated for every pound of waste consumed, and will produce a residuum useful for many kinds of municipal work.



9. CROSS-SECTION MELDRUM DESTRUCTOR.

Reports received from the latest installations of this powerful apparatus show that the actual results are overwhelmingly in support of the statement made by Lord Kelvin.

A paper read by Mr. W. F. Goodrich,

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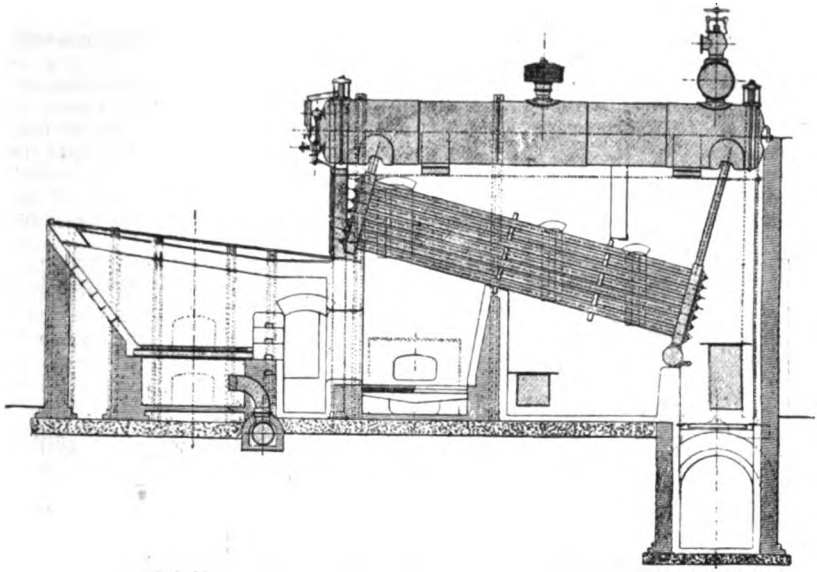
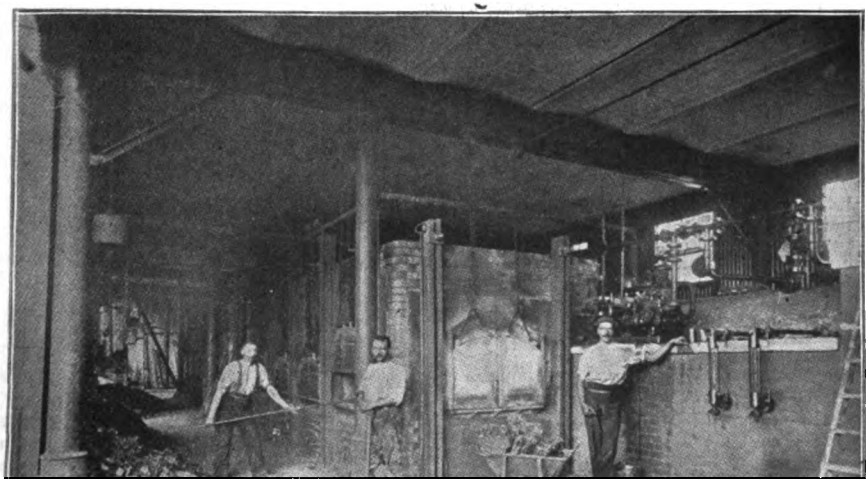


10. LONGITUDINAL SECTION BEAMAN & DEAS DESTRUCTOR,
With Steam Boiler, Air Blast, etc.



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innovation, only some five or six years in use, is the really vital improvement in furnace construction. By this means the temperature has been raised from 500 degreee in 1896 at Hull before the adoption of forced draft to 3,000 degrees in 1902 at Walker-on-Tyne.

It has led to the use of powerful steam boilers developing one-horse power of steam from the combustion of ten pounds of "town's refuse"—corresponding to our refuse will generate a similar quantity of high pressure steam.

Of the 180 towns in Great Britain where destructors are installed sixty-three combine these with electricity works for the lighting of the streets, and in forty towns these destructors are combined with the sewage works. From one ton of town's refuse 40 B. T. electrical units are generated at Nelson, the average being 30 units per ton, equivalent to 40 h. p. hours of

12. MAP OF ENGLAND AND WALES,
Indicating Number of Destructor Furnaces in Use.

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to the minimum. They are placed in close proximity to public offices, schools and all classes of buildings, without objectionable results such as noxious fumes or offensive odors.

In three cases the destructors are combined with waterworks, and the city thus delivers its water supply by the destruction of its waste.

There are 1,650 destructor cells in operation or in course of construction in Great Britain, with 300 steam boilers employed.

Figs 8, 9 and 10 show sections of prominent successful furnaces used in England and Fig. 11 is a photograph of the Beaman and Deas Destructor in use at Darwen, England. Fig. 12 is a map showing the location of refuse destructors in England and Wales and shows in the clearest possible manner the extent of the development in twenty-five years, much of it having taken place in the last six or eight years.

Destructors have been built after the same plans in Australia, New Zealand, South Africa, Germany, France, Belgium and South America, which destroy the miscellaneous city waste of every class, employing the steam power for various purposes, and operating in the same efficient, sanitary and entirely satisfactory manner that has been so well demonstrated by the work performed in English cities and towns.

This, then, is the successful result we should look forward to in this country. There is no radical difference in the character of the people and the manner of living, or in the nature of the waste elements discharged from the life of the people. With the same agencies acting under similar conditions, employed upon the same class of work, it is as certain as daylight that equally profitable results are to be attained. It is only a matter of a clear understanding of the results achieved abroad, and of opportunity for the application of the same methods in this country.

MUNICIPAL MATTERS IN COURT

Higher Courts—Joplin Lighting Plant—Indiana Gravel Road Law—Front Foot Assessments—Extras on Contract—Logansport Street Assessments—Houston Water-Works—Sioux Falls Water Plant.

Abstracts from Decisions of the Higher Courts.

Assessments of Railroad Right-of-Way—R. S. 1893 sec. 120, provides that a railroad right-of-way shall be taxed as personalty, and that such right-of-way gives the company only an easement in the land. It was held, however, that the company was liable for an assessment for the improvement of such road bed as for any other real estate. But in determining the amount of the assessment, the commissioners may not adopt the valuation placed upon the road bed and right-of-way by the corporation commission, because the railroad commissioners in their determination of value consider elements other than the value of the land and the improvements thereon. In determining the amount of the assessments only these elements of value may be considered.—Cheatham County Commissioners vs. Seaboard, etc., 45 S. E. Rep. (N. C.) 566.

Assessments—The statute provides that cities of the third class shall pay for paving and curbing streets, which they have previously graded, by a special assessment. The ordinance may include the cost of grading in this special assessment, if in the judgment of the council, this general fund of the city does not warrant such an expense, providing such ordinance declares the general fund insufficient. In this case the ordinance did not declare the general fund to be insufficient to pay the expense of grading and the contractor was not permitted to recover against the abutting property owners on tax bills issued to him.—City of Sedalia, etc. vs. Abell et al. 76 s w. rep. (Mo.) 497.

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Assessment Warrant, Must Be Paid—This was an action to enforce an apportionment warrant for the construction of a sidewalk. The work was done under section 3706, st. 1899, which does not require the town trustees to permit the property-owner to do his own work. However, the trustees did give defendant such privilege. It was then discovered that the ordinance as passed did not justify the privilege granted, and the defendant was compelled to pay the warrant. It was also held that after the work has been accepted by the council the defendant will not be heard to say that the street grade was not properly fixed. Eversole vs. Walsh, 16 S. W. Rep. (Ky.) 358.

Time for Assessment Defense—This was a suit for a delinquent special assessment. In relation to the different questions raised the court found—1, that where a judgment has been entered confirming a special assessment under an ordinance which has been subsequently repealed, the property-owner may interpose this judgment as a defense in the proceedings for the making an assessment for the same improvement authorized by a subsequent ordinance, but—2, this defense may not be made (sec. 48, c 23, Hurd5s R. S. 1899) to an application for judgment for sale for delinquency. It must be made at a proper time. People ex-rel. Raymond et al. vs. Fuller. 69 N. E. Rep. (Ill.) 371.

Collection of Water Works Rentals—The unanimous vote of the city council to accept offered terms authorizes the installation of water works but does not authorize the Mayor to sign a contract for water and silence of Council upon his report is not ratification of it. The city may assess more than five mills on the dollar for payment of water rentals. The city cannot defeat recovery of rentals when it has recognized plaintiff as owner of works by showing that it has not consented to the assignment of the original contract to the plaintiff. Marion Water Company vs. City of Marion. 96 N. W. Rep. (Iowa) 883.

Lighting Contracts—The charter of the city of St. Paul provides that the acceptance of bid for the lighting of city streets, pursuant to a notice and according to plans and specifications, is a proceeding to be taken only by resolution, ordinance or by-law. An action by the Council whereby it accepted such a bid by motion is void. Broderick vs. City of St. Paul et al., 97 N. W. Rep. (Minn.), 118.

Sidewalk Construction—The statute provides that a sidewalk ordinance may require all abuting property owners to construct sidewalks upon their abutting property, etc., and court held that may shall be read shall. When the council determines that certain sidewalks shall be constructed and paid for by special taxation, this is finding that such walks are needed and that the property will be benefitted to the amount of the taxation. This finding will not be interfered with in the absence of an abuse of discretion, Pierson vs. People, ex rel Walter, 68, N. E. Rep. (Ill.) 383.

Sidewalk Grades—Grades of streets may be established for the building of sidewalks by ordinance and not by resolution. An ordinance prescribes a permanent rule of conduct of government, while a resolution is of a special and temporary character. It was held that an ordinance providing that there should be an excavation of earth four inches below the established grade, "except where it would be better, on account of drainage, to excavate less or grade up at low places," was defective in failing to show a grade with sufficient certainty.—McDowell vs. People ex rel. Martin, etc. 68 N. E. Rep. (Ill.), 379.

Petition for Local Improvements—The statute provides "that when any ten resident owners" of real property in any city etc., shall petition the City Council for any local improvement, such Council shall lay out the entire city or part thereof, as the case may be, into improvement districts. A petitioner must not only be an owner of real estate in a given district, but a resident thereof; and the provisions of this statute are mandatory and jurisdictional. Board etc., No. 60 vs. Cotter, 76 S. W. Rep. (Ark.) 552.

Joplin, Mo., May Build Its Own Lighting Plant.

The United States Supreme Court rendered a decision recently in the case of the city of Joplin, Mo., vs. the Southwest Missouri Light Company, in favor of the city. The right of the city to erect a municipal electric light plant to be operated in competition with those of the present light company was involved.

Indiana's Gravel Road Law Is Constitutional.

The Indiana Supreme Court has declared constitutional the gravel road law enacted last spring. Suit was brought by Melvin L. Bowlin to prevent the construction of a road in Tipton county and the collection of assessments for its cost. He claimed that the title was defective and provided for taking property without due process of law; also that it conferred class privileges.

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Indiana Form of Front Foot Assessment Law Upheld.

The Indiana law for the assessment of the cost of street improvements was upheld in an opinion handed down by the United States Supreme Court at Washington, Nov. 30.

A property owner in Irvington, Indiana, was assessed over $5,000 for street improvements. She resisted payment and the contractor foreclosed and obtained judgment. She appealed to the United States Supreme Court, alleging that the act of the Indiana Legislature, under which the assessment was made, is unconstitutional, in that it provides for an assessment by the front foot. She also alleged that no hearing was had before the Board of Town Trustees to determine the actual benefits; that all of the members of the board were residents of the town and taxpayers, and that two of them were interested parties because they owned lots abutting on the improvement and that its acts were therefore nugatory. The United States Supreme Court holds that an arbitrary assessment by the front foot would be unconstitutional, but it explains that, under the Indiana law, the front foot assessment is subject to alteration or review by the Board of County Commissioners or the Board of Town Trustees, upon a basis of special benefits and that, if the commissioners or trustees refuse to consider the question of special benefits, the property holder's remedy is by mandamus or injunction to compel a hearing as to the amount of assessment on each lot, and, further, that a lot owner cannot waive such a remedy and make a denial of a hearing available as a defense in an action to collect an assessment. The Supreme Court says it finds nothing in the law repugnant to the constitution of the United States and therefore it is upheld.

The argument that two members of the town board were interested property owners is disposed of as follows:

> Although it might have been more seemly for those two members, if they recollected the fact of such ownership, to have refused to act in the matter, yet there is nothing to show their attention was called to the fact.

The judgment of the Indiana Supreme Court is affirmed and the costs are charged against the plaintiff.

Suit for Extras on Chicago Water Works Tunnel Decided.

The Illinois Supreme Court refused a hearing in the Weir, McKechney & Co. case, Dec. 16, which case grew out of the McKechney contracts on the northwest land tunnel of the Chicago water works. The contractors sued the city of Chicago for extras on their tunnel work which the city had refused to pay. The city claimed that the contractors had not fulfilled their contract on their section of the underground construction; also, that they had used material of a kind which was not specified in the contract. The amount at stake with interest was about $700,000.

Logansport Street Assessment Affirmed.

The Indiana Supreme Court handed down a decision Dec. 11 sustaining the judgment of the Cass County Circuit Court in a case filed against the Central Bermudez Company by Lizzie W. Brown et al., at Logansport, Ind. The plaintiff asked that the assessment against her property for paving Market-st. with asphalt, be paid by the city or charged against the account of the Asphalt Company. The complaint set forth that the improvement was ordered when 81 per cent. of the property-owners were against the improvement and that the council passed the order without a two-thirds vote, which was specified by law. The decision of the Supreme Court is as follows:

> (1) A stipulation that all matters bearing on the rights of the parties may be proved and considered under the pleadings, as they then are, waives prior exceptions to rulings on demurrers. (2) Where a city council proceeds under section 4,292, Burns, to pave a street at the expense of abutting owners, without a preliminary petition for the improvement, it is not essential to jurisdiction that two-thirds of the council shall vote in the first instance for an order that the improvement be made and that the clerk shall advertise for bids, if the necessary two-thirds vote in favor of entering into a contract with the successful bidder. If such vote is cast, and the proceedings thereafter until the assessments are confirmed be regular, such assessments are proof against a collateral attack on the ground that a bare majority first ordered the improvement. (3) The preliminary acts of the council are ministerial only.

Houston Water Works Construction Enjoined.

A recent decision by Judge Waller T. Burns of the United States Courts for the southern district of Texas, completely ties up the city of Houston on the water works proposition until a hearing can be had at the next term of the Federal

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Court, which convenes in February. The city could resort to filing a motion to dissolve the temporary restraining order continued in force by the decision of Judge Burns, thereby securing a dissolution of the order prior to that time. Judge Burns continued in force the temporary restraining order granted by Circuit Judge McCormick at Ft. Worth. The city did not file an answer in the case, but simply a pleading denying the jurisdiction of the Federal Court over this case. The court holds as follows :

1. That the plea of the city to the jurisdiction of the court be overruled.
2. That the injunctions heretofore granted by Judge McCormick be continued.
3. That the city be required to remove the sanitary sewers emptying into Buffalo bayou above the water company's dam, and also to remove and abate the polluting nuisance complained of in the plaintiff's bill.
4. That the city be enjoined from advertising for bids, or attempting to enter into any contract, in derogation of its contract with the water company, for supplying to the city water for fire hydrants and public purposes and from otherwise attempting to enforce the ordinance of Oct. 6, 1903, declaring the franchise of the water company forfeited and its contract with the city terminated.
5. That the city be enjoined from enforcing any reduction of rates for water furnished to private citizens.
6. That the city be enjoined from taking water from the water company and using same without paying for it, or providing for the payment thereof, in a manner satisfactory to the water company.

Sioux Falls May Complete Its Water Plant.

In a decision rendered by Judge John E. Carland of the Federal Court, Nov. 12, he refused to issue a temporary injunction restraining the city of Sioux Falls, S. D., from proceeding further in the construction of a new water plant. The South Dakota Water Works Company has sought to impede, step by step, the work of the city. The company has always met with defeat in the state and federal courts. Judge Carland holds that the issue of $210,000 water works bonds is valid. The decision is as follows:

The application for a temporary injunction is addressed to the sound discretion of the court. The facts stated in the original bill and cross-bill are taken as true. Taking them as true, a case for a temporary injunction is stated, if there are not other facts appearing which must control the discretion of the court. This action, speaking now of the original bill and cross-bill, has been a continuing menace to the peaceful construction of a system of water works by the city of Sioux Falls, ever since Nov. 30, 1901, and will continue to be until its merits are finally decided by an appellate court. Notwithstanding the pendency of this action, it appears from the undisputed statement of the mayor of the city, under oath, that the city of Sioux Falls is now engaged in building and constructing a system of water works for domestic uses. That said city has already purchased pipe for entire system, about ten miles of which have already been laid in the ground, and the balance of said pipe is on the ground ready to be laid and is being laid daily by the contractors. That said city has already purchased necessary engines, boilers, pumping plant, pumping station and all other machinery necessary to complete the same. That some of the machinery that has been ordered in special work and manufactured especially for said plant. That the money already actually paid out for material and labor in the construction of said plant, and the machinery, material and work already done, all of which has been purchased or let by contract, amount to about $190,000. That everything needed for the building and construction of said water works system, ready for use, with the exception of one or two items, has already been purchased or contracted for. The city in so doing has assumed the risk of an adverse decision in this case, but that is not the question now before the court.

The question now is: What right or property of the South Dakota Water Company will be injured prior to the hearing of this case on the merits, by refusing a temporary injunction? It is difficult to see any injury at all. On the other hand, what inconvenience and damage might result to the city if the temporary writ should issue? The damage to the city if it shall finally be successful in this litigation would be great and irreparable. It would be nearly impossible to fix with intelligence the amount of the bond that would be necessary to protect the city in case the temporary writ should issue and be finally dissolved.

The court, therefore, bearing in mind that courts of equity, should be very cautious in the use of the writ of injunction prior to the hearing on the merits, and in the exercise of a sound discretion, will balance the inconvenience and damage which the city might suffer by the issuance of the writ as against any injury that the water company might suffer thereby, and in so doing the court finds

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WATER AND SEWERS

Wilmington Filtration Contracts—Extension of New York Supply—Purification of Cincinnati Water Supply—Finances of New York Water Department—Concrete-Steel Standpipe.

The Wilmington, Del., Water Filtration Contracts.

The city of Wilmington, Del., is a city large enough to keep out of difficulties due to failure to obtain independent expert technical advice into which small cities so often fall, but it has not learned from its own past experience and is now in trouble over a contract for a new filter plant for its waterworks, proposed to take the place of an old plant on which the city authorities did not take disinterested advice, and which has proven inadequate.

The Water Board of the city made a contract in March, 1903, with the United States Sand Filtration Company for the preparation of plans for the proposed filter, the use of patent rights and the prospective supervision of construction in which were the following provisions, stated as briefly as possible:

The company agrees to present preliminary plans for the entire plant within 30 days, to receive the city's modifications within 30 days, and to complete the plans in 60 days more, for which it is to receive 2½ per cent. of the estimated cost of the works on completion of plans and an additional 2½ per cent. of the contract price on letting the contract, provided that is within the next three months, otherwise this second payment is to be the same as the first. The city is given the right to use certain patents on details, and any future patents of the company on payment of 10 per cent. of the estimated cost or the contract price, computed under the same conditions as the fee for plans. The company is to be free to bid on the construction and in case it receive the contract agrees to bond itself for $100,000 to $125,000 to construct according to contract, and that the plant will filter 4,000,000 gallons an acre per day, the filtrate to contain not more than 40 bacteria per cubic centimeter on a three months average; the company to make at its own expense any change necessary to produce this efficiency. In case the company obtains the contract it will receive nothing for plans and supervision. An arbitration board is provided for in case of disputes, the expense to be divided between city and company, one member to be chosen by each and the third by these two, or in case of failure to agree, to be chosen from three names given by the president of the American Society of Mining Engineers, the city to reject one, the company the second and leaving the third to serve.

It is estimated in Wilmington that the 15 per cent. of the contract might amount to $187,500.

It seems that when Mr. P. J. Ford became a member of the Water Board, some time after the making of the contract, he objected to its provisions and when the time came for the first payment under it he procured large concessions from the company, whereby the company is to receive $65,000 in lieu of the sum computed as above, the company to give a bond of $150,000 for the efficiency of the plant and to defend the patents. Mr. L. K. Davis of the company was to receive $10,000 for services as consulting engineer. Mr. Ford considers this contract acceptable only because it is a great improvement over the first one—perhaps as great as could be obtained at that time.

Mayor Bird refused to approve this contract and demanded the resignations of the other two members of the board, one of which was received. Upon the refusal of the other to resign he was removed by the City Council, and Mayor Bird asked Mr. Ford to select his two colleagues to succeed them.

The company has entered suit for the $20,000 under the new agreement and also a suit for $100,000 damages for breach of contract.

The latest news from the city intimates the cancellation of the first contract by the Water Board if it is not already void on account of irregularities in its adoption, such as failure to secure the approval of the city solicitor, as required by law; also that Mr. Davis will not be retained as consulting engineer.

The sufficiency of the plans and the efficiency of the filtration system have

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not been called in question, but the troubles of the Water Board are due to lack of proper consultation with the legal advisers of the city and also to a considerable extent to lack of proper engineering advice.

The moral is easily drawn, but its application to any particular case is not likely to be made under the present method of government of most American municipalities.

Extension of New York's Water Supply.

The final report of the special commissioners appointed by Mayor Low of New York City to advise regarding the extension of the city's water supply was submitted to the board of estimate Dec. 18. The commission recommends the immediate construction of a filtration plant for the Croton water supply. The Housatonic, Wallkill and the Ten Mile rivers are discarded as possible sources of supply because they flow into another state and to select them would be to invite litigation. These rivers had been regarded as some of the most likely sources for an additional supply. The commission, which is composed of Messrs. John R. Freeman, Prof. William A. Burr and Rudolph Hering, in reference to Brooklyn and Long Island says:

It has long been known that both the shallow and deep lying sands of Long Island are saturated with water so as to form a great storage volume for that portion of the rainfall finding its way into the sub-surface sands. A large part of the commission's work has been devoted to investigating this question in order to determine, if practicable, what volume of water may be found in these sub-surface sands and to devise the best means of securing it. The Borough of Queens is pressingly in need of additional water, and the Borough of Brooklyn has also reached that point where it must have additional water of good quality. It has already begun to filter its present surface supplies, which are more or less polluted by the increasing population of the southern portion of Nassau County.

It is not generally known that ground water constitutes one of the best possible this great underground storage on Long Island for the boroughs of Brooklyn and Queens, have prompted the Commission to make an exhaustive investigation of that source. A large force under the Commission's direction was engaged in making observations upon the elevation of this ground water in nearly 1,500 wells, the greater part of which are the usual open country wells and the remainder small driven wells made by the forces of the Commission. These investigations were extended over about 1,000 square miles of territory on Long Island, embracing Queens Borough, Nassau County, and a portion of Suffolk County. These saturated sands, constituting this great underground storage volume, reach nearly or quite to the surface at some points; but in the higher portions of the island they may be more than 100 feet below the surface. These investigations disclosed such a large volume of underground water that the Commission recommends extensions of the supplies for the Boroughs of Brooklyn and Queens in the direction of developing means for securing as much as possible of it. At the same time the 500,000,000 gallon supply from the north is to be made available for the same boroughs when desired, by suitable pipe lines extending across East river from the new high-service distributing reservoir north of the city.

The general recommendations are about as follows:

It is recommended that works be immediately begun for the filtration of the Croton supply, and that all the new supplies be filtered. It is also recommended that the reservoirs in Central Park be cleaned and that they be covered as soon as the Croton supply is filtered.

The waste of water has been investigated and found largely due to defective plumbing and fixtures. The leakage from street mains is found to be less than heretofore supposed. This problem of the amount of distribution of the water waste is an extremely difficult one, and it is recommended that these investigations be continued and extended by permanently districting the city for this purpose and ascertaining the inflow and outflow for each district, and that the cause of the large night flow be more fully investigated.

The commission recommends further for

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opinion that notwithstanding the greatest possible reduction of waste a large additional supply of water is imperative.

It is found that all boroughs of the city of New York are in need of an increased supply of water. The present supply is already drawn upon to an extent that might lead to a dangerous shortage in a year of drought.

The cost is estimated at $99,000,000.

The Clarification of Ohio River Water at Cincinnati.

The following paper by Frank J. Kelley before the Central States Water Works Association gives a brief and interesting account of the methods of purification of Ohio river water to be used in the works now under construction at Cincinnati:

As an employe of the Cincinnati water works, I have charge of the hydrant branches, meter and pipe extensions. One of the disturbers of my sleep and peace of mind is mud. Often I have been awakened at night to help some consumer out of his trouble, because of stoppage of his pipe or meter by mud.

For the information of those who are not acquainted with the conditions of Cincinnati, it is necessary to state that the water of the Ohio river is delivered almost directly to the consumer, the reservoir capacity being so small that complete settlement of the water cannot take place.

To give you an idea of the amount of mud handled by the pumps of the main pumping station of our water works, it is only necessary to examine the experiments made in 1898 under the direction of the Board of Trustees of the new water works.

These experiments show the following facts:

Maximum amount of mud per million gallons..... 2,833 gallons
Minimum amount of mud per million gallons..... 24 gallons
Normal amount of mud per million gallons..... 230 gallons

Our last annual report gives the consumption of water to be as follows:

Maximum daily consumption .....57,803,675 gallons
Minimum daily consumption .....23,647,037 gallons
Average daily consumption .....43,033,031 gallons

Assuming for the sake of illustration that the greatest amount of mud was contained in the water on the day of least consumption, we have 55,168 gallons of mud delivered to the reservoirs on that day.

Or take the normal amount of mud and the average daily consumption and we find that there is pumped 3,612,524 gallons of mud during the year. This put into one chunk would weigh 25,000 tons, or formed into a cube it would measure seventy-nine feet in every direction. So that you see my disturber is a very formidable object.

You can also see that to get rid of this mud becomes a very serious matter, and I have asked Mr. Bouscaren, the chief engineer of our new water works, how he was going to change our water, which is not alone rich in color but also in substance, into a clear water. He has taken great interest in explaining the plans to me and I repeat the explanation to you.

For a better understanding of the filter system, it will be necessary to give you a brief description of how the water from the Ohio river is delivered to it.

The pumping station is situated on the north bank of the Ohio river about one-half mile above the Little Miami river. The Ohio here forms a pool, the depth of water being no less than twenty feet when the river is at the lowest stage.

The intake tower is on the south bank of the river in Kentucky, close to the pumping stations of the cities of Newport and Covington. A tunnel, seven feet in diameter, sixty feet below the bottom of the river, connects the intake with the pump pit. The water is then pumped to the settling basins, located in the hills back of the pumping station. These reservoirs, of which there are two, have an available capacity of 350,000,000 gallons, I say available, because their contents are considerably greater, but the extra capacity is used to hold the sediment deposited during the settlement of the water. The depths of the reservoirs vary from 31 to 50 feet, the greatest depth being at the dams where a thirty-inch outlet is provided for the purpose of draining and cleaning them.

The valve closing the outlet is located near the dam in the deepest portion of the reservoir and will be opened and closed by hydraulic power. The bottom of the reservoir descends from all points to this valve, thus enabling the cleaning to be done quickly, experience proving that this work should be performed at least once a year.

The water will remain in these basins from 48 to 72 hours, depending upon the condition of the water in the river, and

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during this time depositing about 75 per cent. of its impurities.

The settled water can be delivered to the mixing basins from the reservoir at any depth. This is done by means of a floating tube, which can be raised or lowered through a vertical distance of thirty feet by chains operated through a windlass on the dam. The water from the settling basins is discharged into a well and this is connected with the mixing basins. There are two of these basins, one having a capacity of 20,000,000 and the other a capacity of 2,000,000 gallons of water, which will be used at different times, depending upon the condition of the water in the river; the larger one being used when the river is muddy.

As the water flows from the well it passes through a grating made of perforated pipes into a large pipe connected at regular intervals with smaller pipes, which in turn discharge into the mixing basin.

The water as it passes the grating is mixed with diluted alum in portions of one to four grains of alum per gallon, the average being 1½ grains, the amount of the alum depending upon the condition of the water. The alum is introduced through the perforated pipes forming the grating. From the mixing basins the water flows on through the filtering beds, where it receives its final treatment.

The filtering beds will be enclosed and the building can be heated by steam. They will be thirty-six in number and each will be about 50 feet long, 26 feet wide and 8 feet deep. They will be constructed of concrete and the top will be surrounded by a trough, the bottom will be perforated so as to permit the filtered water to be discharged into a pipe and from it to the tunnel leading to another pumping station in the city, about four miles west.

The filtering material, beginning at the bottom, will consist of a bed of gravel eight inches in thickness, the gravel being graded from the size of a walnut to the size of a buckshot, the larger size being at the bottom. On top of this will be a layer of washed river sand three feet in depth. The water will be kept at a depth of about three feet.

Each filter will have a daily capacity of from 2,500,000 to 3,000,000 gallons. The total capacity will be from 80,000,000 to 108,000,000 gallons daily.

The water as it leaves the mixing basin the water. This film being a mechanical one, is formed at once and forms a coating on the surface of the sand. It is this film which arrests and holds most of such suspended matter which has not combined with the alum and thus completes the purification of the water. So well does it do its work that the effluent will be 99 per cent.

The rapidity of the filtration makes it necessary to clean the filters every eight hours. This operation will consume about fifteen minutes. The cleaning will be accomplished by draining the filter and forcing filtered water and air by means of a pump from the bottom to the top of the filter, the wash water running through the trough surrounding the filter and from the trough the water flows into the sewer. Five per cent. of the filtered water will be used in cleaning the filters.

The amount of the alum to be used will be determined by a careful examination of the water as it comes on to the filter and as it leaves it. This can be quickly done by an examination for turbidity.

The plans here described are based on extensive experiments made in 1898.

The expert engineers' commission of 1896 recommended the English Filter System. Owing to the fact that our water for half the time differs materially in its character from the waters where this method of purification has been successful it was recommended by the Board of Expert Engineers of 1897 as well as by Mr. Bouscaren and the consulting engineers of the present board, that before proceeding further sufficient reliable data should be obtained with reference to the local conditions. In accordance with the above recommendation an extensive experimental plant was erected capable of handling 400,000 gallons per day, and after an expenditure of $40,000 and experiments extending over a period of nearly a year the following general results were found to be true:

That settling for more than seventy-two hours would not be practicable because: First, the fine particles remaining after seventy-two hours' settlement settle very slowly, the percentage of decrease per day being seldom more than 5 per cent. of the original for the fourth day and steadily decreasing thereafter; and second, the cost would be excessive; that even after settling the water for seventy-two hours and removing seventy-five per cent. of the mud, English filters

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enty-two hours, followed by treatment with alum varying from one to four grains per gallon, the desired purification can be obtained, filtration being at the rate of 125,000,000 gallons per acre per day; that the amount of water required for washing the filter is about five per cent. of that filtered; that if ordinary care be used the amount of acid or alum in the filtered water will be so insignificant as to be harmless.

Finances of New York Water Department.

Mayor Low of New York City indorses the report of the water supply commission. He says in part the following:

The report of the commission contemplates an ultimate enlargement of the city's supply from the north, to the extent of an additional 500,000,000 gallons per day. It is estimated that this supply, with all necessary aqueducts, reservoirs, filtering basins and pumps, can be procured for $100,000,000 and that it will suffice to supply the needs of the city for the next twenty-five or thirty years.

As bearing upon the possibility of financing this large improvement, I ask your attention to the fact that a constitutional amendment is to be voted upon next November which, if it be adopted, will exempt all water bonds of the city issued after Jan. 1, 1904, from the 10 per cent. debt limitation of the state constitution. The necessity for this exemption was foreseen by Comptroller Coler, and it is due to his efforts, as I understand, that the porposed amendment received the necessary assent of the first Legislature.

When it came up for adoption the second time by the Legislature of last winter, in accordance with the state constitution, it came into direct conflict with another provision of that instrument which provides that whenever any question of expenditure for the enlargement of canals is to be submitted to popular vote no constitutional amendment shall be pending. When the Legislature ordered the submission of the canal question to the voters this year it was at first thought that the pending water debt amendment must fail. A happy suggestion of Corporation Counsel Rives, however, saved the day and averted the necessity of commencing again the tedious process of securing the submission to the people of the amendment desired by the city. He pointed out that the Legislature was entirely at liberty, in approving the proposed amendment, to order its submission at any election which it pleased. The last legislature, therefore, gave its approval to the amendment, and ordered it to be submitted to the people in November, 1904. I need scarcely point out to the city the importance of securing favorable action upon this amendment when it is submitted to the popular vote.

The present annual income from water revenues for the whole city is substantially $9,000,000. The cost of maintenance is substantially $2,000,000; interest, $2,600,000; total, $5,200,000, showing a balance of $3,800,000. There are outstanding, in round numbers, $77,000,000 of water bonds, for all parts of the city. Assuming a sinking fund of 1 per cent. for 50-year bonds, the amount anually required for this purpose would be $770,000. This shows a net profit from the present water works of something over three millions of dollars, on the basis of present earnings. If it be assumed that the money necessary for the new water works can be bororwed at 3½ per cent., and that 1 per cent. is necessary to provide a sinking fund, a supply more than equal to that now available for Manhattan and The Bronx can be had for an annual charge of $2,600,000. The figures are: Interest on $60,000,000 at 3½ per cent., $1,950,000; sinking fund provision, $60,000,000, at 1 per cent., $600,000; total, $2,550,000. In other words, the profit, on present earnings from water revenues, would more than pay for the new enlargement up to the extent of 32 million gallons.

The income from water revenues has increased, during the last two years, at the rate of $450,000 to $500,000 per annum. There seems to be no reason why the water revenues should not increase at the rate of $450,000 annually, until the maximum supply is distributed. Every such increase would be largely net profit. It may, therefore, be safely assumed that the new water supply will pay for itself as easily as the present water supply does. It will not only do this, but it will pay, as the present supply would, for the cost of filtration. The commission have not had time to go into these figures as regards the present Croton supply; but the cost of the filter plants is included in the cost of increasing the present supply by the amount of 320 million gallons daily, viz., $60,000,000.

I conclude, therefore, that not only is the need for the enlarged supply immediate and urgent, but also that the new system will be more than self-supporting.

Concrete-Steel Standpipe.

A steel concrete standpipe has just been completed for the water works at Milford, O., which is regarded as novel. It has an 8-inch wall at base, 5-inch at top, 81 feet of water space in hight and is 14 feet in diameter. The standpipe was constructed by J. L. H. Barr of Batavia, Ohio.

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PAVING AND PAVING MATERIALS

Asphalt Company of America—Italian Asphalt—Bitulithic for County Roads—Bitulithic in New York City—Illinois Highway Commission—Oshkosh Improvements — Philadelphia Grade Crossings — Illinois River Bridges—Withholding Payment for Construction—Chicago Construction News—Chicago Track Elevation—Joliet Track Elevation—Kansas City Work—Farmers Want Better Roads—Economic Design of Pavements-Street Oiling Specifications.

Stockholders of Asphalt Company of America Assessed $24,000,000.

The largest stock assessment order known to the court records of this country was signed at Newark, N. J., Dec. 22 by Judge Andrew Kirkpatrick of the United States District Court. This order provides for a levy of $24,000,000 upon the stockholders of the Asphalt Company of America. The right of levy is given to Henry J. Tatnall, receiver of the American Asphalt Company, empowering him to collect from each stockholder 80 per cent. of the par value of the stock.

When the company started in business the holders of its $30,000,000 stock paid only 20 per cent. upon their shares of $50 par value each. Judge Kirkpatrick's order provides for the collection of the unpaid 80 per cent.

The order threatens disaster to prominent Philadelphia capitalists who figured prominently in the promotion of the company and menaces hundreds of smaller stockholders who were led into investment by statements of the company's enormous assets and secure monopoly. These assets were grossly exaggerated, while the monopoly was soon broken by ruinous competition.

The successful carrying out of Judge Kirkpatrick's order will mean the loss of millions to P. A. B. Widener, George W. Elkins, George D. Widener, William H. Crocker and the estates of W. L. Elkins and Ludwig S. Filbert. Some of these men were heavy holders of American Asphalt Company stock.

Many of the stockholders of the old company are insolvent and Receiver Tatnall's campaign will doubtless be directed against the promoters and original stockholders.

The present record of stockholders numbers only ten men and the National Asphalt Company, which is alone credited with 598,852 shares. Among these ten men are Gen. Greene with twenty shares and Avery D. Andrews with nine shares. All told, the holdings of those ten men foot up a total of but 1,148 shares, which would make it appear that Receiver Tatnall could call in only $45,920 upon Judge Kirkpatrick's order.

But the receiver intends to prove that the sale of the Asphalt Company of America to the National Asphalt Company was the result of fraud and conspiracy. With this fact legally established the weight of Judge Kirkpatrick's order will fall upon the original stockholders.

Judge Kirkpatrick's decree goes further than the mere authorization of the $24,000,000 levy. It directs that if the receiver shall find among the stockholders any who are insolvent and unable to pay, and that if he believes any former stockholder may in justice be liable for the stock he shall proceed against such stockholder, using the funds of the estate in his hands in an endeavor to collect. This part of the decree covers the 598,852 shares of stock now outstanding in the name of the National Asphalt Company.

The decree provides further that should the receiver be advised by counsel that such recovery cannot be made he shall proceed with such suits upon being indemnified by any interested party for costs and expenses. This opens the way for suits against the stockholders who assigned to the National Company, either by the receiver on his own motion or through him at the request of any interested party.

By this arrangement it is possible for

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the individual stockholders who have been vainly seeking to intervene in pending suits to proceed now through the receiver.

According to exhibits filed in the Chancellor's Court of New Jersey P. A. B. Widener is named for 1,296 shares of the American Company stock; William L. Elkins, 7,811 shares; George Elkins, 14,621; George D. Widener, 3,700; Sidney F. Taylos, 6,500; George A. Huhn & Co., 29,450; W. J. Latta, 26,036; Frank A. Barnett, 22,900; Amzi L. Barber, 20,082; Rodman Wanamaker, 33,012; Francis V. Greene, 1,000, and C. C. Harrison, 1,000.

This order is issued because the Land Title and Trust Company asserts that the deficiency due to the trust company as trustee for holders of collateral gold certificates on June 3, 1903, was $29,155,833.35.

If the suits begun against the promoters of the Asphalt Company of America to recover profits aggregating $3,699,220.50 are successful there would yet remain a deficiency of more than $24,000,000.

There is no way, it declared, for the Asphalt Company of America to meet this deficiency but by a call on the stockholders for their unpaid subscriptions.

American Capital After Italian Asphalt Deposits.

It was recently reported from Rome that American representatives were making strenuous efforts to buy the famous asphaltum mines, situated in the neighborhood of San Valentino, in the Mazella mountains.

These deposits of natural bitumen are said to be the largest of this kind in the world. Some ten years ago the mines were bought up by a German syndicate, which since has installed modern machinery and also connected the various mines by means of a narrow-guage railway with the station of San Valentino, on the trunk line Rome-Castellamare Adriatico.

At present six mines in the Mazella mountains are being exploited; the asphaltum appears in the form of rock asphaltum, and the quality is said to be the best known. The annual output of the mines, in which some 500 hands are employed, averages 50,000 tons, the bulk of which is shipped to various countries of Europe, to the United States and to South Africa.

At the station of San Valentino a plant of large capacity, installed with up-to-date machinery, has been erected, where the asphaltum rock is ground into powder or pressed into blocks. The magnitude of the deposits may be gathered from the fact that the mines in two districts alone, namely, in Santo Spirito and Piano del Monaci, are said to contain at least 2,000,000 tons of the valuable material.

Bitulithic Pavement for County Roads.

The Highway Commissioners of Fulton County, Georgia, in which Atlanta is situated, have contracted with Warren Brothers Company for about two miles of bitulithic pavement on county roads in Atlanta. They have rented a plant and purchased bitumen, patent rights and expert advice from Warren Brothers Company, and will do the work chiefly with convict labor.

Bitulithic Pavement in New York City.

In the spring of 1903, when Mayor Low took up the administration of New York City, the attention of the officials was brought to the bitulithic pavement, and it was first investigated by President Cantor of the Borough of Manhattan directing his engineer of highways, Mr. George R. Olney, to investigate the pavement in cities where it had been laid. His favorable report was followed by the investigation of the presidents of other boroughs comprising Greater New York, through their engineers, the reports of all of whom were favorable to the bitulithic pavement, and led the Board of Estimate and Apportionment, composed of Mayor Low and the president of each borough, the comptroller and the president of the Board of Aldermen, to adopt the pavement unanimously for several principal boulevards of New York City, including Seventh-ave., Riverside-drive and St Nicholas-ave.

Representative associations of road users, including the Automobile Club of America, the New York Truck Owners' Association, the Road Drivers' Association of New York, the Associated Cycle Clubs of New York, the National Association of Automobile Manufacturers, the Associated Cycling Clubs of Long Island, the League of American Wheelmen and others, investigated the pavement and they unanimously approved of its adoption.

The first act in obstruction was the appearance before the Board of Estimate and Apportionment of persons claiming that the bitulithic pavement was inferior to asphalt, and that, being a patented pavement, it could not be legally specified under the peculiar clause of the New York charter, as follows:

"Except for repairs, no patented pavement shall be laid, and no patented arti-

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cle shall be advertised for, contracted for or purchased, except under such circumstances that there can be a fair and reasonable opportunity for competition, the conditions to secure which shall be prescribed by the Board of Estimate and Apportionment."

Although this provision, which is in no other municipal charter in the United States, has been in the charter of New York City for more than a quarter of a century, it has never until this time been adjudicated, and it offered an unusual opportunity for pressing obstructive tactics.

Specifications for the bitulithic pavement were unanimously adopted by the Board of Estimate and Apportionment for the paving of Seventh-ave. boulevard. The asphalt interests obtained an injunction restraining the award of the contract and the Appellate Court rendered a decision to the effect that patented pavements are not barred out under this provision of the charter.

The Park Department of New York City, desiring to adopt the best form of pavement for paving Seventy-second-st. from Central Park west to Riverside-drive, a street seventy-five feet in width, covering an area of 18,000 square yards, advertised for bids for paving the street, taking bids for sheet asphalt and asphalt blocks as well as for bitulithic. The bid of Warren Brothers Company for its bitulithic pavement was $2.40 per square yard, while the lowest bid for asphalt was the ridiculously low price of $1.15, this price having evidently been made as a final effort to further delay the laying of bitulithic in New York City.

The Park Department, however, did not consider sheet asphalt to be the pavement for this boulevard and recommended to the Board of Estimate and Apportionment the award of the contract to Warren Brothers Company. The Board of Estimate and Apportionment unanimously approved this award, and this result, after two years' stubborn opposition and the bringing of three independent injunction suits in the name of the Barber Asphalt Paving Company as an injured taxpayer, with all delays known to the law in each, probably ends the obstructive tactics which can be employed to prevent the yard; sheet asphalt, Barber Asphalt Company, $1.15; Century Construction Company, $2.20; Sicilian Asphalt Company, $1.80; Warren's bitulithic, $2.40 a square yard.

Illinois Highway Commission is at Work.

The Illinois Good Roads Commission is sending to all the highway commissioners of that state a circular letter accompanied by a list of questions. These questions are designed to elicit information regarding the highways of the state, with a view to determining the best and most economical methods for their improvement. The Good Roads Commission was created by an act of the last General Assembly for the purpose of investigating "the various problems of road building in Illinois, such as the best and most economical native materials, the best system of road drainage, the best and most practicable methods by which the burden of cost may be equitably distributed among all the people, such as federal, state and county aid, convict labor, etc."

The act provides that the results of the studies of the commission shall be embodied in a report to the next General Assembly with recommendations for legislation on the subject, and it is believed that the latter and list of questions now being sent out will furnish valuable statistical information which will materially aid the commission in its work. The commission is composed of the following: Chairman, DeWitt S. Smith of Springfield; Harold U. Wallace, Chicago; Robert D. Clark, Peoria. The members serve without compensation.

Improvements in Oshkosh, Wis.

A statement has been prepared by G. H. Randall, city engineer at Oshkosh, Wis., showing that about $123,000 has been expended during the year on streets, bridges and parks. The amount expended on street repairs was about $15,000, which is in addition to that expended for new streets.

Philadelphia Wants a Million Dollars

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nel. To Mayor Weaver is accredited the new item to abolish grade crossings. The loan bill will be voted on in February.

Illinois River Bridges Obstruct Navigation.

All of the bridges across the Illinois river with the single exception of the one at Lacon have been declared nuisances by the War Department. This criticism is the result of an inspection by one of its corps of engineers, in which it developed that the piers on which the draw spans rest are constructed in so faulty a manner as to stand as an obstruction to navigation. Included in this are two city bridges and two railroad bridges at Peoria and eleven others that span the river at other points. The government recommends that lines of piling be driven on both sides of each pier in the shape of a double wedge so that steamboats striking them shall be deflected into the channel. Complaints against the changes ordered will be heard by Capt. Ritchie of the engineering department of the government, at Chicago on Jan. 4.

A New Reason for Withholding Payment for Street Construction.

Application was made to the New York Supreme Court Dec. 4 by the Barber Asphalt Company for an order compelling Comptroller Grout to pay $14,000 for paving Lexington-ave. near One Hundred and Twenty-ninth-st. Comptroller Grout refused to authorize the payment on the ground that a citizen had served notice on him that she had suffered severe injuries by a fall due to the faulty construction of the pavement and she intended suing the city for damages. As the Barber Asphalt Paving Company had given bond for only $7,000, this sum would be insufficient to protect the city from loss if she should receive a large amount of damages. Justice Scott reserved decision.

Chicago Construction News.

The year closes with the cement market somewhat demoralized. Prices are nominally from $1.25 to $1.50, but there is very little business at any figure. It is expected that the action of the Association of Portland Cement Manufacturers in deciding to close down for six weeks or more some time between Jan. 1 and April 1 will put up the price of the eastern cement, but the feeling also prevails that the western manufacturers outside of the association will continue to market their product at present prices and some even anticipate that the figures on the western product will go still lower.

Meacham & Wright have secured the contract from Joseph J. Duffy for supplying 150,000 to 170,000 barrels of cement for the work of the firm at Lockport. The price at which the contract was taken was not made public.

The South Park Commission of Chicago has purchased a fifty-acre tract and another of ten acres for $32,820, which will be used for small parks in the southern part of Chicago.

The local board of improvements is pushing asphalt paving for State-st., between Thirty-ninth and Sixty-third-sts., together with a new system of sewers on both sides of that street. The work will cost about $500,000. The cost of sewers to the front foot of property is estimated at $3.50, and of asphalt paving at $6 to $7.

The corporation counsel of Chicago has rendered an opinion to the City Council holding that a gas company or any other public service corporation has no right to tear up any street that has been paved and is in good condition. It is proposed to notify the gas company of each improvement and if it wants to lay pipes in the thoroughfare it must do so before the improvement is made. If it does not take advantage of such notification the company must lay its pipes under the parkway on either side of the street or else under the sidewalk.

The Municipal Art League recommended at a recent meeting that beauty in lamp-posts should be encouraged by offering prizes for designers, and suggested a competition for fountains and other sculptural decorations intended to adorn street corners. The league also decided to urge more artistic electric light signs for stores and other establishments in the downtown business districts.

Gen. Henry Strong is preparing to erect at the southeast corner of State and Adams-sts., a building to be practically fourteen streets, one above the other, lined with stores, a retail shopping district with the blocks set one upon the other. He seeks to accommodate retail shopkeepers who want stores on State-st., but cannot pay the present high rents. Through the center of each floor will be wide arches, and retail stores will face on these, making each floor practically a street one block long. The build-

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ing will be 100 by 145 feet, with caisson foundations and steel work to support seventeen stories if it is decided to add more floors.

At the annual meeting of the Chicago Drainage Board in December the following officers were elected: President, Zina R. Carter; vice-president, William G. Legner. With the cash on hand, the amount of bonds that can still be issued and the unpaid taxes the district has a working capital for the coming year of $5,175,000. The board has adopted plans for the improvement of the north branch of the Chicago river and contracts for the work will be let sometime in January.

Stone dealers have asked the local Board of Improvements to specify that concrete foundations may be of crushed stone, cement and crushed stone screenings.

Progress of Track Elevation in Chicago.

More work was accomplished in Chicago during 1903 in railroad track elevation than in any previous year. In a report to the City Council on Dec. 20 John O'Neill, the city's track elevation expert, stated that 8.25 miles of main track have been elevated, 66.5 miles of other tracks and forty-one subways constructed, and $3,165,250 expended during the year. He says:

The different railroad companies commenced the work of elevation this year in the month of May, and since that time have placed upon their right-of-way over 2,000,000 cubic yards of sand filling and built over 84,500 cubic yards of retaining and abutment walls of concrete masonry. They have eliminated forty-one grade crossings, all of which are open to traffic though not fully completed. When completed these forty-one subways will be spanned by over 234 iron bridges sixty-six feet in length and weighing about 1,700 pounds per running foot. The work of track elevation has given in all its ramifications employment to over 45,000 men this year, all the expense of which has been borne by the railroad companies. The amount paid by the city has been only the expense of the department considered the most important work of the year. Regarding this he says:

This elevation was commenced on May 14 last and since that time they have placed under the seven tracks from 150 to 170 loads of sand daily, averaging thirty cubic yards to the car, or nearly 750,000 cubic yards of sand. The embankments composing this elevation are supported on the sides of the right-of-way by heavy retaining walls of concrete masonry. This company has also elevated its freight yards between Sixty-fourth and Sixty-sixth-sts., a distance of 1,320 feet, and between the west line of the right-of-way and Armour-ave. At Sixty-third-st. it has constructed a stone depot, which is reached by carriages on a terraced driveway running from the north line of Sixty-fourth-st. up to the elevation of the depot. This piece of elevation is not quite completed, but will be nearly completed before the end of the year. Under this ordinance the company has elevated two miles of main tracks and about seventeen miles of other tracks, eliminating seventeen grade crossings by subways, at an estimated cost of about $2,000,000, $325,000 of which was expended in 1900 in the construction of retaining walls and foundations for the abutments.

Ordinances have been passed and accepted by the different railway and railroad companies this year for the elevation of their roadbeds and tracks as follows:

Miles of main tracks	6.0
Miles of other tracks	26.5
Subways to be constructed	44
Estimated cost of entire work when completed	$2,400,000

Work of elevation done this year was as follows:

Miles of main tracks elevated	8.25
Miles of other tracks elevated	66.5
Subways constructed	44
Cost of entire work	$3,165,250

Ordinances passed by the City Council and accepted by the railroad companies for the elevation of their tracks from May 23, 1892, to Dec. 31, 1903, cover the following amount of work:

Miles of main tracks to be elevated	138.10
Miles of other tracks to be	

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Joliet Track Elevation.

The City Council at Joliet, Ill., has directed City Attorney McKeown to prosecute all suits against all railroads for violations of the track elevation ordinance.

Street Work in Kansas City.

The report of Emmet King, secretary of the Board of Public Works at Kansas City, Mo., shows that during the three months ending Oct. 20, 153 contracts for grading, paving, curbing, sidewalks and sewers have been completed at a total cost of $324,157.85. The distribution of expenditures was as follows:

	Miles.	Cost.
Street paving	2.35	$ 83,614.40
Paving alleys	0.18	2,997.34
Asphalt repairs	4.20	10,822.61
Street grading	6.38	40,483.56
Grading alleys	0.99	1,500.29
Artificial stone curbing	6.11	12,568.74
Curbing and guttering	1.31	5,668.55
Artificial stone sidewalks	8.02	33,835.40
Natural stone sidewalks	0.08	453.90
Brick sidewalks	0.18	579.84
District sewers	3.24	127,085.29
Repairs, sidewalks and curbing	....	274.75
Work paid by vouchers	....	798.63
Work paid by appropriations	....	324,157.85

Indiana Farmers Want Better Road Law.

A resolution was adopted at the Allen County Farmers' Institute, which was held at Ft. Wayne, Ind., Dec. 2, declaring that the farmers of Allen County favor "such a revision of our present road laws as will secure the construction of permanent macadamizing." Also, that the Senators and Representatives of Allen County be requested to give the matter the attention necessary to secure the proper legislation.

The Economic Designing of Pavements.

By A. W. Dow, Engineer Department, District of Columbia.

(A paper before the League of American Municipalities at its convention in Baltimore.)

In presenting to you a paper on Paving, I am impressed with the fact that there is less known about this branch of municipal engineering than of any other, or I put this differently and say that we have still more to learn about this branch than any other. We are really only now finishing the foundation of our education in this industry. Strange as this may sound to you in the light of the enormous amount of paving that has been done in this country in the past fifteen years, yet it is so, for our present method of paving is nearly entirely lacking in system and science. We make little or no study of the conditions that the pavement has to meet in its existence, and do not make sufficient distinction in the class of pavements for different streets and different localities.

Before going further I would beg your indulgence for following the much-used path pursued by writers on this subject, that is, of making some remarks on the ancient history of the subject, and call your attention to the pavements or roads built by the ancient Egyptians, Carthagenians and Romans. It is not, though, for the purpose of presenting these old pavements as examples, or of extolling the methods employed in their construction, but only for the purpose of illustrating more forcibly the character of the problems in this industry that we have to deal with at the present day. Our attention is often called to these ancient roads, to their marvelous life and endurance, and by some, to the fine engineering displayed in their construction. But in the light of intelligent engineering this last is greatly overdrawn, as there is no good engineering displayed in the construction of these pavements, and they they are only monuments to an extravagant waste of labor and material and examples of methods that we want to avoid. It does not require an engineer to build a structure that will endure if the builder is allowed an unlimited amount of material and labor. The skillfully constructed work is that which is an economic combination of good properties supported by a strength having a sufficient factor of safety.

There is nothing that better illustrates the difference between the ancient and the modern pavements than a comparison of the ancient and modern civilization. In the early day of civilization the welfare of man was entirely dependent upon his strength, his capacity to overcome and resist things with brute force. The successful man in those days was the one that could wield the heaviest club or sword and bear the heaviest armor. All other qualities were sacrificed to the building up of strength and endurance, and so it is with the ancient pavement constructed of huge stones or masses of masonry, in many cases six feet in thick-

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ness, built solely for the purpose of endurance and resisting traffic through its brute strength, built with no purpose in view other than that of resisting. In our modern times the man with strength alone counts for little. The most successful man is the one in which various desirable traits are governed by a good intellect, and the whole frame supported by a sufficient bodily strength to insure health, even under an excessive strain of mental energy. And so it should be with the modern pavement. It should be an economic combination of many good properties, sustained by a strength sufficient to maintain it under the maximum strain to which it may be subjected during its existence. As the training of the modern man is studied and planned so as to produce a combination of faculties that will serve him best in the profession he is to follow, so should the pavement be studied that is to pave a certain street.

We must free ourselves from the barbaric methods of building pavements, that is, of putting down some material that we think will be the most durable, irrespective of whether it answers any other purpose or not, and also of a method so much in use today of paving every street with the same class of pavement, irrespective of whether the conditions of the street are suited to that pavement, or even suitable to the materials used in its construction. This last practice we cannot hope to do away with until we have abandoned our present method of selecting pavements from the bargain counter of competitive bidding. This method of selecting pavements that is now in vogue with the majority of muncipalities, would not be countenanced in any other business, and until we have learned how to select pavements that will best meet the requirements of the street to be paved, we cannot hope to pave our streets economically and well. What would we think of a firm who made a business of the use of sheet metals for various purposes, such as roofing, tank

Can anyone consider that an economic way of doing business? That the selecting the kind of pavement and even the kind of material to use in the same class of pavement is necessary is demonstrated each day to anyone who makes a careful study of the wearing of different pavements. It is a common occurrence to find two pavements laid at identically the same time, under the same specifications, and with the same materials, and with apparently the same amount of traffic on both streets—one pavement gives a most excellent surface, costing practically nothing for repairs for over ten years. The second pavement begins to act poorly in two or three years, and by five years it is in need of extensive repairs. What has caused the difference in these two pavements, both laid in identically the same manner? It is evident that this difference is the result of some physical condition existing in the second pavement that does not exist in the other, and that if it is possible by any means to change the conditions so that they will be identical in both pavements the one will last as long as the other. If, on the other hand, it is found that the conditions cannot be changed economically, it shows conclusively that another class of pavement not injuriously affected by that condition should be selected for the paving of that particular street.

In other words we must learn to study thoroughly the characteristics of the various paving materials, and classes of pavements, what physical conditions in the streets act detrimentally on one class and not on another, and what physical properties it is desirable for the pavement to have to be the best suited for the class of traffic and the comfort of the property owners of the street under consideration. We should treat the paving of streets in a similar manner to the educating of men. We must study their adaptability and endeavor to develop them in the line which, after careful study, we conclude they will best be adapted to. As some men will make utter failures in some professions, and be most successful in others, so it

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other with a view of determining the difference in the conditions that were responsible for the success and the failure. It is owing to this that we have some cities going so far as to pass ordinances prohibiting the use of certain classes of pavement, while others are using the same with marked success and economy. This has done much to retard progress in paving.

The necessity of a study of conditions and factors is well appreciated and recognized by such authorities on paving as Tillson and Baker, as both these authors give tables in which they assign figures to represent the value of different factors such as cheapness, durability, ease of cleaning, ease of traction, foothold, ease of maintainance, favorableness to travel, sanitariness, etc., but these tables and their discussions are principally adapted to differentiating between the different classes of pavements, and do not emphasize the necessity of studying the effects of existing physical conditions on the different materials entering into the composition of the pavement, and also upon its physical construction. Such factors should be discussed under the heading of durability. Their existence is recognized by Tillson, for he says " Durability, too, is affected by so many varied conditions that it is discussed with difficulty." But pavements should not alone be studied during their manufacture and laying, but should be watched carefully during their entire life, and careful record kept of all failure and the probable cause.

The question now naturally arises as to what is the most satisfactory and economical result in paving. The methods of contracting for paving that are in general use at the present day, and especially that branch of the contract that relates to the guarantee have been so ably discussed before the American Society of Civil Engineers by Messrs. Hazelhurst, Whinery, Lewis and others that it would only be repetition on my part to undertake to discuss in full these methods, so I will only call your attention to a few essential points, and advise all who are at all interested in paving to read these most instructive papers in the transactions of the American Society of Civil Engineers, Dec. 1902.

The method in most general use today is to draft specifications going considerguarantee all work and keep same in repair without expense to the municipality for a stipulated term of years, the most common period being five years. The method adopted by cities for protecting guarantee is to retain a ceretain sum of money, say 10 per cent., from the original cost of the pavement.

Another method is to have the contractor give bond, guaranteeing the fulfillment of the guarantee. Possibly the most serious objection that has been pointed out in such specifications is requiring the contractor to guarantee that his pavements be kept in good repair for a certain term of years. As has been justly remarked on this point, where are we to draw the line between the paying for the pavement and the keeping of it in repair? Would not the property-owners in such a contract be justified in complaining that they were paying for maintenance of the pavement when such work is chargeable to the city, and, as pointed out by Mr. Whinery, is it justice for property-owners on a heavily traveled street to pay more for the identical pavement than property-owners are paying on a lightly traveled street? With a time guarantee even as short as five years there is the danger that the paving company or its bondsmen may fail to make good the guarantee, and the pavement be left in a poor condition with repairs necessary at the expense of the city.

Another objection which applies to any guarantee system is the question in what condition should a city expect its pavements at the expiration of its guarantee? This will always be a bone of contention between the city and a close contractor. An objection to the present method of operation under this class of specifications is that considerable detail is given as to the methods of laying the pavement. and of producing materials, and that as yet there is hardly a city that has such an inspection as to know whether these specifications are carried out. Under these circumstances the entire performance of the work on the pavement is left to the contractor, and is largely dependent on the foreman he employs, both in the manufacture of the pavement and the laying of it. Such reliance without a thorough inspection is dangerous, and in a number of cases has proved disastrous

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the laying of the pavement, and his experience has taught him that good results are often obtained by cheaper and quicker methods than those in the specifications. He is naturally led to believe from this that such great care as is specified is not necessary for the production of good work, and he will then make such changes in the manipulation as he thinks will either be a saving to his employer, or produce a good record for himself of laying more pavement with less expenditure of money. But let me add that he is often justified in following his own methods, as those of many specifications if closely followed would result in poor work.

Another objection that may be raised to the technical part of such specifications is that the same class of pavement is asked for for every street. The contractor and possibly even the city is not aware of the physical conditions existing on these streets, and yet the contractor bids and guarantees to lay the same pavement on every street alike.

Another method of letting contracts that is in use by some cities and which especially does away with the objections which are raised to the long-time guarantee is that the city pay a certain sum for the pavement, and require in the specifications that after five years the contractor is to keep the pavement in repair for a certain period, for which he will be paid a stipulated sum per square yard. This likely in some cases is an advantage over the first method mentioned of contracting for paving, but it, too, is open to objections, which have already been reviewed and discussed in the papers before mentioned.

Some cities at the present time are undertaking to do their paving on the municipal plan. This, I believe, in some cases, will prove very advantageous and economical to the municipality, but a careful study should be made of conditions before a city adopts this method of paving. In the first place they should consider whether the amount of paving which they do in a year is sufficient to warrant their erecting a plant; for how long each year this plant will be working, and if not constantly, will it be economical to retain the men employed in its running? If the men are discharged at keep its one plant well employed, is that after the city has invested in its paving outfit, and its force has been trained, it will naturally be restricted to only that class of pavement for which they have been equipped. Another objection which a number raise to municipal construction is that it will give an opportunity to politicians to secure places for their constituents, irrespective of their suitability for such positions, and such men are not likely to produce good work. It appears, however, that all serious objections to municipal construction are dependent upon conditions and without doubt many cities could devise methods that would be economical whether these methods be entirely or partially carried on by the municipality.

There are three methods which I believe might prove desirable for municipalities to construct pavements. One of these, which I have just discussed, is that of municipal construction. If a city does sufficient paving during a year to keep a plant and pavers occupied, either at laying new pavement or repairing old, and their government is such that politicians will not enter into the selection of the skilled laborers necessary to the performance of this work, paving can, without doubt, be done very economically. Before a city adopts this plan it should be sure that it has a man in charge of the work who is not only competent to lay good pavements, but of being able to study the different factors and physical character of the street to be paved.

Another modification of the method would be for cities to hire a paving plant and gangs of men from contractors, the city furnishing all or part of the material to be used in the production of the pavement. Of course this plan is open to many modifications depending on how much work the city would do, and how much material they would furnish or require the contractor to furnish. By laying pavements under the municipal plan, or by the modification just suggested, the city has the advantage of being able to discriminate between different materials to meet the conditions of the various streets under construction.

The method which I believe would be the most generally advantageous is for a city to employ a man who is competent to take entire charge of all branches

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where conditions require a change from the detail of the specifications. The contract should only require that the pavement be guaranteed for two years, by specifying that any defective workmanship or material which might develop during the guarantee period should be immediately made good by the contractor. By this means the objection made to to the 5, 10 and 15-year contract system, especially when paving is paid by assessing the abutting property-owners, that the property-owner is not alone paying for the construction of the pavement but for its maintainance, would be overcome.

Such a system would make possible a thorough examination of the character of all streets to be paved and the selection and use of only that class of pavement that is best suited to the conditions of the several streets. It, of course, goes without saying that with a thorough inspection the city will obtain far better work in paving and besides it will correct an evil that is so prevalent in the paving business today, which is responsible for much bad paving and for which many cities will have to pay dearly for in repairs and defaulted contracts in the future. I am speaking here of the competitive bidding that is carried to such a pass that it is hardly possible for a contractor to make any money if he is held to the requirements of the specifications.

I will not attempt any detailed description of how such a method could be carried out in a paper such as this and then it is more than likely that the detail would vary with the conditions met with in different cities, but I believe they will be found to be the simplest of any of the systems in vogue at the present time.

It is evident that whether the paving be done by municipal construction or by the two-year guarantee system, the work must be in charge of a competent man, one who is especially trained in this line. It is to be regretted that there are so few such men, and that the science of paving is so overlooked and neglected by our technical institutions. Should there be a demand for men making a specialty of this subject our institutions would not be long in giving courses which would meet the demand.

It has been my object in this paper to point out to you how lax our present to be so lightly treated may be the better appreciated when you consider that in the twenty-five years preceding the year 1900, 120 cities spent approximately $75,000,000 in first cost of asphalt pavements alone. True, this class of pavement has been the most popular, but it would be safe to estimate from these figures that during the time there was much over $100,000,000 spent for all classes of so-called improved pavements. It is estimated that New York City alone will spend over $4,000,000 per annum to keep the present paved streets of the city in condition. I do not believe that I am far from right in saying that there will be over 8,000,000 square yards of pavements laid this year in the United States at a cost of $15,000,000, and how much study and forethought is given to all this work, and to what extent are the specifications being adhered to?

That we are not getting today what our specifications call for in all cases is evidenced by the low prices some cities are paying for pavements. It is certain that if a contractor is to be paid a price less than what it will cost him to lay a pavement under a specification he will shirk his work in some way so as to make some profit, for he is not in the business for philanthrophic motives. It is just a year ago that this society was addressed on the subject of paving by Mr. Fendall of this city, when he advised a combination of the different cities for the purpose of reducing the price of pavements, but I believe a more advisable plan would be to combine more for the purpose of regulating the prices to pay for pavements rather than to lower it. A contractor is surely entitled to a price that will insure him under average conditions a fair profit. The lesson must be learned that a cheap pavement is not generally the most economical, and only by a reconstruction of our present methods can we hope to secure a satisfactory system of paving.

Street Oiling Specifications at Bakersfield, Cal.

The city of Bakersfield has adopted the following specifications covering the construction of oiled streets:

First—The street, after being graded in accordance with specifications for grading streets in city of Bakersfield, will be ready to receive the oil.

Second—The quantity of crude mineral

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cent. of water and heated to a temperature of not less than 200 degrees Fahrenheit when being applied.

Fourth—The oil shall be applied as follows: The street shall be plowed to a depth of six inches, then be coated with oil at the rate of one gallon of oil per square yard of area; then the oil shall be plowed under to a depth of four inches and then harrowed with a disc harrow, or rolled with a Fitzgerald spike roller; then a second coating of oil shall be applied at the rate of one-half gallon of oil per square yard of surface area of street. The street shall then be harrowed or rolled with the Fitzgerald spike roller till the oil becomes thoroughly incorporated with the surface material of the street. Then the street shall be rolled till sufficiently compacted to withstand ordinary traffic without rutting.

Fifth—When accepted the street shall be on the established grade, having a true and even surface and crown.

Sixth—The contractor shall furnish all material and appliances necessary for the prosecution of the work to completion in a thorough and workmanship manner.

Seventh—Bids shall state price per barrel (42 gallons) of oil applied on street according to the method prescribed in these specifications.

Eighth—The work shall be performed under the superintendence and to the satisfaction of the street superintendent and city engineer.

Ninth—The Board of Trustees reserve the right to reject any and all bids.

The specifications were adopted as prepared by City Engineer Evans.

ELECTRICITY

Erie Municipal Conduits—Electric Light Statistics—Electric Shocks from Fire Streams—Construction and Maintenance of Electric Wires.

Municipal Electrical Conduit System in Erie, Pa.

During 1898-9 the city of Erie, Pa., constructed 137,300 linear feet of ducts for electric wires underground and has since added 22,083 feet, making a total at this time of 159,383 feet constructed and in use. The total cost, including the expense of connections, poles, cross-arms, guy wires, iron pipe on poles, manholes and castings therefor, repairing over trenches on paved streets, etc., complete was $18,056.75.

Of the space in the ducts 19,372.5 linear feet is occupied by the N. Y. & Pa. Telephone and Telegraph Company, 18,633 feet by the Mutual Telephone Company, 10,134 feet by the Western Union Telegraph Company and 8,296 feet by the city fire and police signal system.

The revenue derived from the use of the conduit for the year ending April 3, 1903, was $2,378.41. The total revenue received to Sept. 25, 1903, was $6,738.71.

We are indebted to B. E. Briggs, City Engineer, for this information.

Electric Shocks from Fire Streams.

One of the objections to the erection of electric wires on poles in cities is the hindrance which such wires offer to free access to a burning building by means of ladders and fire towers. It is at times also necessary to cut such wires to afford access to a burning building—a work which is not highly appreciated by the fire fighters. Another difficulty presents itself also, namely, the danger to the firemen from electric shocks due to currents carried to the nozzle by the stream of water when it comes in contact with live wires. Such shocks have more than once been of sufficient strength to disable firemen for a time, but, so far as is known, no fatalities due to this cause have occurred. In order to ascertain to what extent firemen are subject to risk of life, if at all, when the stream of water thrown from the hose strikes against live wires a series of experiments were recently undertaken in Germany. They were made with pressure of 6,000 volts alternating current and 550 volts direct current. The stream of water was directed against a portion of the wires from which the insulation had been previously removed. With the 6,000 volts pressure it was found that the resistance of about one foot of ordinary hydrant water reduced the potential of the current to a point when it was not dangerous, but the effects were not pleasant. When the resistance of the water was lowered by the addition of 0.05

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STATISTICS ELECTRIC LIGHT OF SIXTY-FOUR SMALL CITIES.

Compiled by M. W. Mix, Mayor of Mishawaka, Ind.

	Population, 1900.	No. of Street Arcs.	Cost of each per year.	Schedule.	Meter rate per K. W.	Cash discount.	Ownership.	Investment.
ILLINOIS.								
Belvidere	7,000	105	$65 00	M. L.	20c	25%	P	
Centralia	8,000	72	72.00	M. L.		5%	P	
Dixon	8,979	75	80.00	M. L.			P	
Harvey	5,000	96	60.00				P	
Macomb	5,375	$114	72&96	M. L.			P	
Mattoon	9,662	132	48.00	A. N.			M	$25,000.00
Monmouth	8,252	107	66.00	M. L.	20c	25%	P	
Mt. Vernon	6,000	52	65.00	A. N.	10c	20%	P	
Paris	6,105	102					M	25,000 00
Pekin	8,460	108	65.00	M. L.	11c	5%	P	
Urbana	5,728	74	75.00	M. L.	20c	25 to 50%	P	
INDIANA.								
Alexandria	7,300	53	90.00	A. N.	8c	None	P	
Bedford	6,115	70	80.00	A. N.	None	"	P	
Bloomington	7,000	73	80.00	A. N.	10c	"	P	
Brazil	8,000	101	62.40	M. L.			P	
Columbus	10,000	83	46.50	M. L.			M	10,000.00
Connersville	6,836	90	75.00	A. N.	15c	5%	P	
Crawfordsville	6,649	148	60.00	A. N.	12½c	None	M	100,000.00
Frankfort	7,100	121	60.00	A. N.	7½ to 20c	"	M	75,000.00
Greensburg	5,700	87	75.00	M. L.	None	"	P	
Hartford City	6,789	120	80.00		10c	"	P	
Jeffersonville	11,000	127	46&54	A. N.			P	
Kokomo	10,960	119	70.00	A. N.	10 & 12c		P	
Mishawaka	5,560	76	65.00	M. L.	11c	None	M	
Mt. Vernon	7,000	74	69.75	A. N.			P	
Peru	9,000	87		A. N.			M	60,000.00
Wabash	8,618	28	76.00	A. N.	12, 10 & 8c		P	
Washington	10,000	144	70.75	M. L.	None		M	75,000.00
MICHIGAN.								
Adrian	9,654	*112	64.80	A. N.	14c	None	P	
Benton Harbor	6,532	*50	72.00		14c	5 to 50%	P	
Coldwater	6,216	81	60.00	M. L.	10½c	10, 15 & 20%	M	45,194.88
Holland	7,790	64		A. N.	8c		M	80,000.00
Ionia	5,000	60	75.00	M. L.			P	
Ironwood	9,705	63		M. L.	8c		P	
Ludington	7,166	49	65.00	M. L.			P	
Monroe	6,200	86	51.00	A. N.		5%	M	25,268.00
Owosso	8,986	†120	65&95		15c	5%	P	
Pontiac	11,000	136	57.60	M. L.	15c	5%	P	
Ypsilanti	7,000	120	29.80	M. L.			M	18,000.00
OHIO.								
Bellefontaine	6,649	90			8½c	None	M	20,000.00
Defiance	8,000	80	75.00			5 %	P	
Delaware	9,000	134	77.00	D. H.	10c	None	P	
Galion	7,282	109	72.00	M. L.	10c	"	M	42,000.00
Gallipolis	5,432	65	64.50	A. N.	Not used	"	P	
Glenville	5,558	42	82.92	A. N.	None	"	P	
Greenville	5,501	100	78.00	A. N.	15c	"	P	
Kenton	6,852	110	75.00	A. N.	10 to 25c	"	M	125,000.00
Lancaster	8,991	105	85.00	A. N.		"	P	
Middletown	9,215	111	84.00	Sun	10 to 20c	10%	P	
Mt. Vernon	6,663	110	69.00	A. N.	None		P	
Niles	7,490	*66	75.00	D. H.	10c	None	M	70,000.00
Norwalk	7,074	105	70.00	Mid.	12c	10%	P	
St. Marys	5,859	73	50.00	M. L.	10 to 15c	None	M	33,500.00
Sidney	5,688	75	75.00	A. N.	9c	"	P	
Tiffin	10,989	160	80.00	A. N.			P	
Van Wert	6,422	70	76.55	M. L.			P	
Wellston	8,045	100	70.00	M. L.	10c	40%	M	40,000.00
Xenia	8,696	113	63.00	M. L.	15c	None	P	
KENTUCKY.								
Bellevue	6,632	62	75.00	M. L.			P	
Bowling Green	10,000	90	50.00	A. N.			M	25,000.00
Frankfort	11,464	108	96.20				P	

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per cent. of soda, the minimum safe length of the stream was increased to about 40 inches. With 550 volts direct current a dangerous voltage was not reached with pure hydrant water, but with the same percentage of soda in the water harmful potentials were indicated by the volt meters used in the tests when the stream of water was only three inches long. On the whole the results of the experiments showed that the danger to firemen from the contact of water from the hose with live wires carrying high potentials is not ordinarily so great as has been generally supposed hitherto. This, however, is no reason for lessening the precautions looking to the safety and best interests of all concerned in this matter.—Cassier's Magazine.

THE DIRECTORY OF AMERICAN CEMENT INDUSTRIES

The rapid and great development of the cement industries demands a third edition of the "Directory of American Cement Industries," which will be issued early in 1904. It is the only complete representative of the cement trade in all its branches, and consequently there is an increasing demand for it which makes frequent editions necessary. Advantage is taken of the opportunity to revise and improve the book each time and these improvements will be specially notable in this third edition.

The expansion of the directory features has been so great that the Hand-Book is now bound separately and can be obtained either separately or in combination with the Directory or with Municipal Engineering Magazine.

The enormous expansion of the manufacture and use of cement shows itself in every department of the Directory.

Thus in the list of Descriptions of Works, the second edition had 240 entries, while the third edition will have about 360 entries, an expansion of 50 per cent.

The new works which are in operation are fully described, which makes a considerable addition to this most valuable section of the book. There have been so many additions to the older factories, so many of them have been rebuilt, and they have added so many new plants to their existing works, that this whole chapter has been rewritten, scarcely a single description remaining the same in is of direct benefit to the reputation of their brands of cement, so that a few who have heretofore withheld information are now ready to supply it in full.

As a consequence of this rapid development of the industry there have been many abortive attempts to organize companies, there have been many combinations, and there have been some abandonments of old-fashioned plants. The list is therefore divided into two parts, the first giving the names and descriptions of existing plants, of those under construction, and of those companies which are in process of establishment or of formation. The second part of the list gives all the names which at the date of issue have dropped out of the business world, either from change of name, from absorption by other companies, from failure and liquidation or from abandonment before actual construction had begun. This second list will be of considerable value, though not having the indispensable nature of the first list.

Following the descriptions of works will be given the list of companies which are in existence with locations of offices and works, names of all officers and directors, and sales agents, capitalization, capacity, names of brands of cement manufactured and their kind and the transportation routes available. For convenience of users of the book this list is separated from the list of descriptions of works and will be found to be a full and concise business directory of all the manufactur-

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list are collected in a separate list, arranged alphabetically as names of brands, each name accompanied by a statement of the kind of cement, the name of the manufacturer and of the general sales agents handling it, thus giving in a convenient form just the information about a cement brand which is wanted and referring to the lists of cement manufacturers and descriptions of works for greater detail.

The names of general sales agents are also collected from the list of manufacturers into an alphabetical list, giving names and addresses of agents, names of companies for which they act and of brands they handle.

The importance of the import trade during the past year and the slowly growing importance of the export trade lead to a considerable improvement in the section devoted to the foreign cement trade, in which will be found the names and addresses of the principal manufacturers of cement in foreign countries and of the brands of cement which they manufacture. The improvement in this list, especially as regards German and French manufacturers, is marked and it gives all the information which is called for by our correspondents at this time upon the subject of foreign cements. A few descriptions of foreign cement works are given to show the differences in processes of manufacture from those which have been developed so recently and so originally in America. Like all the other departments in the Directory this one aims at giving all the commercial information which can be desired at this stage of the development of the cement trade, and, in fact, more than is required.

The list of dealers in cement is considerably increased, and has been thoroughly revised so that it represents completely the cement trade in all cities in the United States of 2,000 population or more and of some others, very few cities indeed having failed to respond to our requests for the latest information. The manufacturers of and sales agents for cement are listed under their appropriate postoffice addresses so that this list serves also as a geographical list of factories and distributing points.

The rapid extension of the use of cement has caused a large addition to the number of contractors using cement. Although there are many changes each year in the contractors and it is necessary to eliminate many names of those who have failed or who were in the business but temporarily, there is a very large increase in this list, which is estimated at 50 per cent., though all the returns are not yet in. The list includes all contractors, workers in cement and large users who do their own purchasing of cement. The value of the rating feature, introduced in the second edition, has been recognized and it is now possible to tell from the list how much cement within certain defined limits a contractor uses. Practically all of those not showing the rating for cement used consumed less than 500 barrels a year.

There is a considerable addition to the list of engineers, architects and other supervisors of the use of cement, for the same reason given for the increase in number of contractors. These men make the specifications for the use of cement and have considerable advisory power over the selection of brands of cement to be used on their work.

The list of laboratories and engineers making analyses and tests of cement and cement materials, and of engineers who design cement plants has been thoroughly revised, and so have the lists of makers of and dealers in machinery and supplies for cement plants and for cement users.

The valuable credit rating feature introduced in the second edition has been improved and extended for the third edition. The recognition of its value has led many more to respond to requests for information upon which to base the ratings quoted and they will be found fuller and quite as reliable as those given in the first edition. The feature is one which was expected to be of slow growth and the publishers of the Directory are much gratified at the rapidity with which it has received recognition and the alacrity with which information is furnished.

The table of freight rates has been revised and extended to suit the increase in the factories in operation and is still worth many times the cost of the book to those purchasing or selling quantities of cement, large or small. The evidences of saving in money on account of intelligent consultation of this table come to hand frequently.

A new feature of the book is an outline map of the United States showing by appropriate marks the location of cement plants in operation or proposed, the difference being shown by differences in symbols. This is an interesting exhibit, especially to those who are considering the establishment of new cement plants.

In conclusion it may be said that the third edition of the "Direcory of American Cement Industries" will be a material improvement and extension of the previous editions and that it will continue to represent the enormous advance in the trade as completely as its predecessors.

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MUNICIPAL AND TECHNICAL LITERATURE

Municipal Reports.

Municipal Reports.

Receipts and Expenditures of Ordinary Revenue of Boston, Mass., 1898-1902. Special Publication No. 9. Statistics Department.

This is one of the occasional publications additional to the regular monthly bulletin of the Boston City Department of Statistics, and shows the receipts and expenditures of the city for the years named, so separated and arranged that comparisons can be made of various items from year to year. Analyses are made by departments and by funds under each department, so that almost any desired detail short of individual vouchers can be found. If more cities made such publications as this there would be greater economy in many departments, for leaks could be more readily traced.

Appendices give the financial statements of the last two or three years in the uniform form proposed by the National Municipal League, and show the advantages of this form of making annual reports.

A Repair Plant for Asphalt Pavements for the Borough of Manhattan. Recommended by George Livingston, Commissioner of Public Works. With an appendix embodying the result of an expert investigation by James C. Bayles. Made to Jacob A. Cantor, President of Borough of Manhattan, New York City.

This report outlines a plan for municipal plants for repairing asphalt streets, including seven section stations in Manhattan. The recent grand jury recommendation of an asphalt repair plant owned by the municipality is set forth in detail, with tables of number, length and area of street openings each year, aggregating nearly fifty miles of trench. Arguments are made against the present system and for the direct responsibility of the city for present conditions, closing with a recommendation of the appropriation of $100,000 for a municipal asphalt plant.

present repair contract by which concrete costs $6 a cubic yard, binder costs $1.52 a square yard and wearing surface costs 45 cents a square yard. He favors a short period of guaranty, only sufficient to develop bad materials used in construction or errors in manipulation. He shows that there are now no trade secrets in asphalt manipulation, that there are plenty of men of skill and experience to be secured, that machinery and tools are on the market, that there are many independent sources of suitable asphalt and that there are no basic patents on asphalt mixtures. He believes that the cost of the work under municipal operation will compare favorably with that by contract.

The estimates of cost of plants are given in detail, amounting to about $30,000 for the central station on the river front for receiving and preparing materials for use and $2,500 each for steam rollers and tools for seven section stations, making nearly $50,000 for the equipment of the plants, not including ground and buildings. The annual fixed charges including interest, superintendent and assistant and eight foremen are estimated at $16,900. The cost of laying the repairs is estimated at 80 cents a square yard, 30 cents being for the asphalt, 15 cents for the other materials and 35 cents for mixing, carting and laying. He thinks the utilization of old material might reduce the cost at times to 50 cents a square yard.

Annual Report of the Board of Public Works of the City of Milwaukee, Wis., for 1902. Charles J. Poetsch, City Engineer.

The main items in the report are the following:

In the Water Department the total receipts were $579,032.48, an increase over the previous year of about 8 per cent. The disbursements were $168,238.17 for operating expenses, of which $21,000 was returned for taps, etc., made; $105,060.35 for extensions of water mains, of which about one-third was assessed as benefits

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withstanding the much-discussed reductions in water rates, there is a considerable profit from the works above all charges except depreciation. Nearly 11 miles of new mains were laid.

The sewerage department laid 16,000 feet of brick sewer and 23,000 feet of pipe at a total cost of $202,776, of which sum less than one-fifth was paid by special assessment. About $41,000 of this amount was for cleaning and repairing sewers and catch basins. The Jones Island sewage pumping plant lifted nineteen billion gallons of sewage and river water at a cost of $17,832. The plant also furnishes light and power to operate the garbage plant. The Milwaukee river flushing works forced over seventeen billion gallons from the lake into the river to flush it, at a cost of $18,887. A flushing tunnel of the same sort for the Kinnickinnic river is under construction.

The mileage of streets and alleys improved is 19½ at a cost of $455,230, a trifle less than half of which is assessed on the abutting property. New sidewalks were 8½ miles long, of which nearly 4 miles were cement.

Street sprinkling cost $64,569. Street cleaning cost $98,000, alley cleaning $21,000, and removal of ashes and rubbish $125,000.

The board also constructed several school houses, five engine houses, a natatorium and public library station and a garbage plant.

The garbage plant cost $80,630, of which $12,500 was for the right to use the processes.

Three natatoriums were maintained at a total cost of about $14,000 and were used by about 650,000 persons. Two of them were run all the year round and one for three summer months.

The new Grand-ave. draw bridge was constructed at a total cost of $87,522.

An ordinance has been passed and accepted providing for the depression of the Chicago & Northwestern Railroad in the Eighteenth ward, and bridges over the tracks at the street crossings.

ORGANIZATIONS AND INDIVIDUALS

Portland Cement Manufacturers—Fargo City Engineer—Professors for Engineering Schools—Indiana Engineering Society—Scranton Engineers' Club—Technical Meetings—Personal Notes.

The Association of Portland Cement Manufacturers.

Questions of importance to the cement trade were settled at the second annual meeting of the Association of Portland Cement Manufacturers, held Dec. 8 in New York. Forty-two companies were represented, being a large percentage of the $350,000,000 capital invested in the business. The meeting was held to enable the members to exchange views as to the best methods of manufacturing cement and of extending and developing the business; to consider the reports of committees, and to elect officers for the ensuing year.

A number of the members represented to the association that because of the enormous demand for cement during the last two years they have been compelled to keep their mills in continuous operation day and night, and it had been impossible to make repairs. In view of this fact a resolution was adopted that the members of the association should close their mills for six weeks or more between Dec. 1 and April 1, to enable the necessary repairs to be made.

It was the consensus of opinion that, with prices as they are at present, the imports of foreign cement, amounting to about $2,000,000 in 1903, would be decreased considerably during the coming year. The amount of cement on hand at the various mills on Dec. 1 was found to be light, and much lower than had been anticipated. The association will erect a building at the St. Louis Exposition at a cost of between $35,000 and $50,000.

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Robert W. Lesley of the American Cement Company retired from the office of president and was succeeded by J. B. Lober of the Vulcanite Portland Cement Company; A. F. Gerstell of the Alpha Portland Cement Company, formerly secretary, was elected vice-president; E. M. Young of the Lehigh Portland Cement Company, formerly treasurer, was elected secretary, and E. R. Ackerman of the Lawrence Cement Company becomes treasurer. The new executive committee consists of H. W. Maxwell, W. H. Harding, R. W. Lesley, W. R. Warren, George E. Bartol, E. M. Hager and S. B. Newberry.

A banquet was given by the association at Sherry's at night, at which a silver loving cup was presented to R. W. Lesley, the retiring president.

The companies represented at the meeting were as follows:

Alpena, John Monaghan; Alpha, A. F. Gerstell; Alsens, W. S. Sinclair, Mr. Babson; American, R. W. Lesley, J. W. Eckert, Wallace King, George Norris, C. M. Camm, H. B. Warner; Atlas, Howard W. Maxwell; Bonneville, W. H. Harding; Castalia, W. J. Prentiss; Catskill, J. W. Kittrell; Cayuga Lake, M. E. Calkins; Central, R. E. Griffith; Chicago, Norman D. Fraser; Coplay, J. T. Brady, Gabriel Blum, J. L. Berg, R. L. Morrell, James Butler; Dexter, G. E. Bartol, J. Brobston, G. A. Schneebele; Edison, W. S. Mallory, Lovell H. Carr, W. S. Pilling; Elk Rapids, Mr. Sly; Empire, C. A. Lockard, Mr. Kingsbury; German-American, G. C. Prussing; Glens Falls, W. W. Maclay, Byron Lapham; Helderberg, T. H. Dumary, Mr. Farrell; Hudson, L. C. Smith, E. Bravender, Mr. Bernard; Illinois, E. M. Hager, Morris Metcalf; Lawrence, E. R. Ackerman, M. S. Ackerman, L. V. Clark; Lehigh, E. M. Young; Martins Creek, J. B. Wight; Thomas Millen Company, . Millen; Nazareth, P. H. Hampson, M. J. Warner; Newaygo, B. T. Brecker; Northampton, Mr. Dunn; Peerless, J. R. Patterson; Peninsular, J. W. Shooe; Phoenix, J. Turner, Mr. Zipperlein; St. Louis, J. C. Robinson, E. E. Paramore, A. J. Craney, jr.; Sandusky, S. B. Newberry, P. B. Beery; Virginia, W. R. Warren, F. H. Lewis, F. W. White, D. E. Rianhard; Vulcanite, J. B. Lober, B. F. Stradley, W. D. Lober, W. R. Dunn, H. A. Shaffer, Albert Meyer; Wayland, V. T. Whitmore; Whitehall, W. B. Whitney, Thomas M. Righter, W. E. Erdell; Wolverine, L. M. Wing; C. H. Wood; Standard, W. G. Henshaw of California.

The extracts given herewith from the report of the executive committee will show the progress which has been made by this committee and sub-committees toward the settlement of many questions of great interest to both makers and users of cement. In this connection it may be suggested that the third edition of the Directory of American Cement Industries will be issued in 1904 and will contain the latest and fullest information about the cement factories of this country and the latest and fullest information available upon the production of and the demand for cement for domestic consumption and exportation.

The report of the executive committee, of which R. W. Lesley of the American Cement Company, was chairman, reads in part as follows:

The executive committee beg to report as follows:

Your association grew out of a call, signed by twenty-three companies, for a meeting at Sherry's, Forty-fourth-st. and Fifth-ave., New York, on Sept. 11, 1902.

The subject of the call was stated to be as follows:

"The undersigned manufacturers of Portland cement, recognizing the fact that the present methods of handling of 'sacks' are almost universally unsatisfactory, and believing that the question can be profitably be discussed and a satisfactory plan evolved at a meeting of the eastern mills, hereby pledge themselves to attend such meeting."

Prior to the meeting, the gentlemen in attendance enjoyed a very charming lunch and during the course of the informal speeches, the thought of such an association as we now have, was brought forward. The thought was father to the deed, and our association was formed with twenty members signing the constitution.

At the first annual meeting of the association there was submitted to the association, which was composed of representatives of eastern mills only, a suggestion on behalf of the Central Association of Cement Manufacturers, composed of western mills exclusively, that the two associations should co-operate. This important suggestion met with the full approval of your association, and at the quarterly meeting on March 10, 1903, ten companies, members of the Central Cement Association, were present, and all became members of our association, thus making the Association of Portland Cement Manufacturers no longer local, but a National Association. The membership has now grown from twenty to forty-six, representing manufacturers from the Atlantic to the Pacific Coast. The estimated output of Portland cement which is now represented in our body being from 90 per cent. to 95 per cent. of the total product of the United States.

During the year there were brought forward many questions involving freight rates and also other transportation questions. The most important of these and the settlement of which was brought about by co-operation between our asso-

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ciation and the railroads, was a uniform method regarding the return of empty bags. This action resulted in the issuance of uniform circulars by all the the member of our association to their respective customers, and, similar notices by all the railroads to their freight agents, resulting in a uniform method for the return of bags and the payment of freight thereon.

In the fall there was also a reduction of freight to Chicago and western points not taking the 60 per cent. rates; another result of the work of our transportation committee.

Under similar lines of co-operation, a committee was appointed by your association to confer with representative manufacturers, members of the Iron and Steel Association, in the matter of testing and standards for concrete steel construction. This suggestion, which had root in our association, has extended from the two associations originally contemplated to the American Society of Civil Engineers, which will bring up the matter at its next annual meeting in January, 1904, and to the American Society for Testing Materials, which has appointed a committee to act in unison with those already referred to. The effect of this will be that by standard methods in this important form of construction the possible danger to the cement industry by improper and careless construction of concrete steel bridges, buildings, etc., will be entirely obviated.

The importance of a standard specification for cement has certainly been recognized by all of those connected with cement, either as engineers, consumers or manufacturers. Certainly, no class recognizes it more fully than the members of our association. To do away with the many hundreds of varying specifications which come to the mills during the course of the year, and to substitute for them a single specification, well thought out, well considered and well adjusted, would be of great value.

Following the line of co-operation already referred to as part of the business of this association, your cement committee has been represented upon a joint committee of the American Society for Testing Materials. This society is seeking to find a field as a general clearing house for the making of specifications in the interest of consumers, engineers and producers. The committee to which this matter of uniform cement specifications has been referred is composed of engineers connected with the drafting of the United States army specifications, of the entire committee of the American Society of Civil Engineers on the manipulation and testing of cements, of representatives of the engineering departments of the New York Central, Baltimore & Ohio, Illinois Central and Pennsylvania railroads, of representatives of the Cement Committee of the American Railway Engineering and Maintenance of Way Association. The Institute of Architects has been invited also to be represented on the cement committee of your association.

The methods of manipulation adopted in the progress report of the American Society of Civil Engineers, were made the standard for the purposes referred to, and samples of some eight different cements were sent to some thirty-odd laboratories to be tested in accordance with the methods described. These tests have been completed and a summary has been made of them, and from this summary a suggested specification has been laid before the committee of the American Society for Testing Materials, and has now been sent for final examination and approval to all its members, with the object of having replies by February 1, 1904, at which time a meeting will be held for the final adoption of the specification.

It is needless to say that a standard specification, which has grown from the intelligent work of the American Society of Civil Engineers' committee, coupled with the thought of the United States army engineers, the American Railway Engineers and Maintenance of Way Association, the American Society for Testing Materials and your own association, and practically determined in the laboratories to which the samples were sent, will, when adopted, command the regard and respect of all engineers, consumers and producers of cement.

Further in the line of co-operation with sister societies may also be mentioned the meeting held in New York on Dec. 1, 1903, between your committee on uniform contracts and a committee appointed by the National Builders' Supply Association to confer with us on the subject named. This was the first meeting between the manufacturers of, and the dealers in, cement, and it may be stated that the best of feeling and co-operation marked the meeting, and that it was thought highly advisable by both parties that many similar meetings should be held during the course of every business year, and the National Builders' Supply Association havea emphasized their views on the subject by extending to our association an invitation to join the annual meeting of the National Builders' Supply Association, to be held at Buffalo, N. Y., on Feb. 3, 1904.

The manufacture of Portland cement by the United States government, on the site of the Tonto Dam, in Arizona, was brought before your executive committee by representatives of mills on the Pacific coast, and in connection with these gentlemen who have now become members of our association, an effective argument was addressed to the Secretary of the Interior. After a hearing of several hours in which the matter was fully gone over, a decision was rendered giving the victory to the cement men, the government deciding not to make cement on the site of the dam, but to advertise for bids for cement under either of the two following methods, viz.:

First—Cement manufactured elsewhere and shipped to Phoenix or Globe by rail, and then hauled to the dam site.

Second—The government to furnish a

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250-barrel-per-day mill at the site with power to operate it, and the contractor to manufacture it there.

Fargo's City Engineer Earns His Salary.

Mr. Sam F. Crabbe, city engineer at Fargo, N. D., recently asked the City Council to reduce his salary 50 per cent. during the winter months, as his time is only about half employed during that season. After recovering from their surprise the Aldermen decided to allow Mr. Crabbe to earn all this salary during the busy months, but to continue paying his salary as heretofore.

Professors for Engineering Schools.

One of the problems to which engineering schools ought to give immediate and serious consideration has grown out of the practice of obtaining professors by "in-breeding," as it has been characterized, meaning by this the recruiting of the young teachers, soon to be developed into full-fledged professors, from among recent graduates, with little more than their school experience to their credit. This species of selection has become an increasing fashion within the past ten years, or perhaps better put, an increasing necessity, due to the cramped financial conditions ruling with most of the schools, and the result has undoubtedly been a narrowed degree of usefulness of instructors and professors, and a more closely circumscribed value in the engineering market of the young graduates forced into it. In a few instances, it is true, prominent engineers, actively engaged in professional work, have been induced to lecture occasionally at such schools, thus vitalizing the college atmosphere with the spirit of actual engineering and through such lectures some good has been accomplished. In several recent instances, also, men fresh from engineering fields have been secured as the heads of engineering school departments, and as such afford admirable illustrations of a policy which is to be much commended.

Indiana Engineering Society.

The Indiana Engineering Society presents a program for its convention at Indianapolis Jan. 14, 15 and 16, 1904, which promises to be more than usually interesting and valuable. It indicates that the society is endeavoring to include all branches of engineering in its interests. The program includes among others the following:

"The Indiana Assessment Law," by C. A. Kenyon, Indianapolis.

"The Indianapolis Municipal Testing Laboratory," by Walter Buehler, Assistant City Engineer.

"Computing Machines," by Prof. C. B. Veal, Purdue University.

"Structural Timber," by Prof. W. K. Hatt, Purdue University.

"Bridge Abutments and Piers," by Prof. W. D. Pence, Purdue University.

"More Light on the Theory of Concrete," by S. B. Newberry, Sandusky Portland Cement Company.

"Stream Pollution in Indiana, with Special Reference to the Purification of Strawboard Refuse," by M. O. Leighton, United States Geological Survey.

"The Sewer System of Connersville," by Karl L. Hanson, City Engineer.

"Sewerage and Sewage Disposal at Bedford," by G. C. Houston, City Engineer.

"The Septic Tank and Filter Bed of the Eastern Hospital for the Insane," by Prof. R. L. Sackett, Earlham College.

"Filters vs. Contact Beds in Sewage Purification," by W. S. Shields, City Engineer, Chicago, Ill.

"The New Centralized Power and Heating Plant of Purdue University," by Prof. J. D. Hoffman.

"Steam Heating from Central Station," by Fred B. Hofft, Indianapolis.

"A New Automatic Stationary Engine," by F. F. Shandler, Indianapolis.

"Power Chains and Their Use," by Charles H. Hills, Indianapolis.

"Smoke Prevention," by R. P. King, Indianapolis.

"Cost Keeping," by Harry B. Marsh, Indianapolis.

"Locomotive Testing at St. Louis Exposition," by Prof. W. F. M. Goss, Purdue University.

"Surveys for Electric Railway Construction," by Charles L. Sellers, Peru.

"Interurban Railways in Small Cities," by John W. Fulwider, Lebanon.

"Some Special Street Railway Work."

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neer's Club, held at Philadelphia Nov. 21, "Cement and its Uses" was the topic of discussion.

The annual meeting of the Iowa Brick and Tile Association will be held in Mason City, Ia., Jan. 20 and 21.

The annual convention of the Illinois Clayworkers' Association will be held at Danville, Ill., Jan. 5 and 6.

The Wisconsin Clayworkers' Association will hold its fourth annual meeting at Portage, Wis., and the dates as now proposed are March 1, 2 and 3.

The midwinter good roads meeting of the National Good Roads Association will be held at Ormond Beach, Fla., Jan. 28 and 29.

At the annual convention of the League of California Municipalities at Stockton, Cal., Dec. 9, the subject of oil for good roads was discussed. A. T. Lightner, trustee at Bakersfield, stated that his city has thirty miles of oiled streets; that last year 11,000 barrels were applied at a cost of 60 cents per barrel, ninety barrels being used in the first application on each 350-foot block, the width of all streets being fifty-one feet. C. B. Seeley of Napa said that oil had been tried on twenty-five miles of macadam with satisfactory results. Considerable attention was also given to the litigation whereby the inventors of machines for applying oil are attempting to recover damages. The use of salt water for street sprinkling was thoroughly discussed.

The December meeting of the New England Waterworks Association was held in Boston Dec. 9. A paper on "Notes on the Building of a Storage Reservoir" by Walter H. Richards and one "Rainfall and Runoff from Catchment Areas" by Lewis M. Hastings, C. E. of Cambridge, Mass., were read. W. R. Grace, superintendent of waterworks at Rockland, Mass., urged the desirability of making water rates a lien on the property occupied by the consumer and moved the appointment of a committee of three to look into the matter and report at the January meeting. The matter carried and the president stated that he would appoint the committee later.

Personal Notes.

W. J. Harsett has been elected mayor at Sacramento, Cal.

Hon. E. E. Schmitz has been re-elected

Charles E. Phelps, jr., has been reappointed chief engineer of the municipal subways of Baltimore, Md.

Peter J. Ford has been elected president of the drainage board and William G. Legner vice-president, at Chicago.

John R. Hardin has been appointed park commissioner at Newark, N. J., to succeed Howard W. Hayes, who died Nov. 26.

John C. Brackenridge, M. Am. Soc. C. E., has been appointed commissioner of public works of the borough of Brooklyn.

N. L. Taylor, who gave up the office of city engineer at Tacoma, Wash., Dec. 31, 1903, has established an office at 801 N. I-st., Tacoma.

W. A. Cattell, M. Am. Soc. C. E., consulting engineer, has removed his offices in New York City from 42 Broadway to the Park Row Bldg.

Hon. C. C. Digby, mayor of Charleston, Ill., visited Indianapolis, Ind., Dec. 12 to obtain some information regarding street cars and interurban roads.

C. H. Danenhower, conduit engineer of the Cincinnati Gas and Electric Company, Cincinnati, O., was appointed general engineer of that company Dec. 1.

Mr. Thomas Cyprian Frenyear, sales manager of the new Canadian Westinghouse Company, died of typhoid fever at Ft. William, Canada, on Dec. 10.

Henry Burton has been elected superintendent and consulting engineer, and Thomas Riddle, jr., chief engineer to the Water Board at Port Huron, Mich.

Williams & Whitman, civil and sanitary engineers, have removed from 702 Fuller Bldg., New York City, to 902 Whitehall Bldg., Battery Park Place.

O. Perry Saile, C. E., 146 Westminster-st., Providence, R. I., has been appointed engineers of waterworks and sewers at Hickory, N. C. Edward W. Shedd will be associated with him.

Messrs. Fred J. Potters, Samuel E. Bower, William A. Shreve, Joseph L. Caughlin and David R. Brown have been appointed members of the water commission at Bordentown, N. J.

Oliver N. Eiler has resigned as superintendent of the municipal electric light and waterworks plants at Portland, Ind., to accept a position with the S. M. Smith Company at Noblesville, Ind.

W. H. Hall of Birmingham, Ala., has been appointed superintendent of public works at Columbus, Ga., to succeed Robert L. Johnson, who was killed by the caving in of a trench Sept. 30.

John D. Allen has been appointed vice-president and general manager of the Allis-Chalmers Company. Mr. Allen has been associated with the company for more than twenty-five years.

Gen. Francis V. Greene, commissioner of police, New York City, has tendered his resignation to take effect on Dec. 31, to become general manager of the Niag-

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troit, Mich., Nov. 29, aged sixty-three years. Mr. Merdian was a paving contractor, his business being conducted under the name of the Henry Merdian Company.

Charles Baillarge has resigned the duties of city engineer at Quebec and has been succeeded by his son, W. D. Baillarge, who has the title of acting city engineer. Mr. Baillarge has filled the position of city engineer for a number of years.

Hon. Alen C. Fobes, newly-elected Mayor at Syracuse, N. Y., has appointed heads of departments under his administration as follows: Ralph S. Bowen, commissioner of public safety; Aaron R. Thompson, commissioner of public works; corporation counsel, Walter W. Magel; city engineer, Frank J. Schnauber, reappointed.

Frederick W. Cappelen, former city engineer of Minneapolis, Minn., has been engaged by the special council committee of that city to assist in determining the cost of producing electric power in that city and to secure comparative figures of the cost of electric lighting and power in the various cities of the United States under similar conditions.

Robert Grimes, prominent in bridge building, died at Elmira, N. Y., Dec. 8. He was for years connected with the Union Bridge Company. Among the bridges he built are the first iron pier at Coney Island, the cantilever bridge at Louisville, the viaduct from the Harlem river to the Grand Central Station in New York City.

MACHINERY AND TRADE

The American Road Roller Company.

The American Road Roller Company is a new corporation, of which William Churchill Oastler, Asso. Am. Soc. C. E., is president and Jay Conger is treasurer. It is the successor to the business of Wm. Churchill Oastler and also to that of the Conger Manufacturing Company. The principal offices of the company are at 156 Fifth-ave., New York, and the works are at Groton, New York. Mr. Oastler has carried on a business in steam and road rollers and street and street cleaning and construction machinery for over twenty-five years and his machines are widely and favorably known. The Conger works at Groton were completed just before the combination was made and the new company starts out with better facilities than the old and with the prestige of the reputation of both of them.

Allis-Chalmers Company's New Standard Reynolds Corliss Engine.

We illustrate herewith a new Corliss [illegible] represents the experience of twenty-six years in building of Corliss engines and combines all of the desirable elements of the best designs.

Engines of the type illustrated are being built in seven sizes, ranging from 50 to 500 horse-power, and are designed for steam pressures up to 150 lbs. They are built of somewhat shorter strokes than have heretofore been customary in Corliss engines, with the idea of economizing in space and making the construction more rigid. The speeds are also somewhat higher than usual, ranging from 110 to 150 revolutions per minute, although these speeds are not higher than those at which the Reynolds-Corliss engines of older design are frequently operated.

The frame is cast in one piece with the slide, the construction being of the box type, resting on the foundation for its entire length. The main bearing shells are bored into the frame, thus insuring a solid bearing and also permitting the easy removal of the shells by rolling them out around the shaft.

The slide is of the barrel type with [illegible]

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cast-iron base plate, which extends under the valve gear, serving as a drip pan.

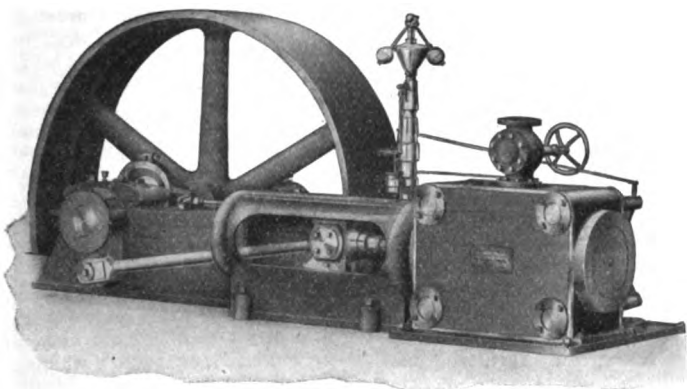
The valve gear is of the usual Reynolds Corliss type, the wrist plate being of skeleton pattern and fitted with a new type of disconnecting device which, while clamping the hook rod firmly, is very easily detached by hand.

The dash pots are of differential plunger type without leathers or packing of any kind.

The regulator is of the high-speed weighted type, designed to control the engine within narrow limits of speed variation.

The connecting rod is of steel with solid forged ends, fitted with bronze boxes, babbitt-lined on the crank pin ends, the boxes being adjustable by means of screw actuated wedges.

The crank pin is of plain type, polished on the face, and is protected by a planished steel oil guard (not shown in cut).



NEW CORLISS ENGINE OF ALLIS-CHALMERS CO.

The engines are fitted either with belt flywheels, as shown, or with square rim wheels where used with direct connected electric generators. The crank and crosshead pins and main journals are of a size ordinarily used with heavy duty engines.

In brief, the engine is strong, simple and compact, and while nothing has been added for ornamentation, nothing contributing to economy or durability has been omitted, and the machine should find a large sale among power users who appreciate quality.

Kentucky Rock Asphalt for Floors and Pavements.

The Wadsworth Stone and Paving Company of Pittsburg, owners of rock asphalt mines on Green river, Kentucky, who for the past two years have been using American rock asphalt which they had formerly laid, have opened a New York office at 32 Broadway, under the management of Mr. T. Hugh Boorman.

They are now selling quantities of their mastic to contractors throughout the country and there is a special call for it for brewery floors.

This mastic contains nothing but pure material, viz.: Silica, carbonate of lime and bitumen, free from residuum oils or earthen or vegetable matter, which no imported mastic can claim.

The company is also preparing to deliver rock asphalt powder ready for use by municipalities for repairs and are perfecting plans for moderate cost machinery of improved construction, which will be much appreciated by city engineers and commissioners of public works.

A Press for Making Cement Pipes.

The Kielberg molding press has been used for some years in Europe for making cement pipes and is now being introduced in this country by H. Schebye, C. E.

The machine uses a cylindrical mold, inside of which works a mandrel, which serves the double purpose of forming the inner surface of the pipe and of compacting the cement paste or mortar of which the pipe is made. The mold is made in two semi-cylindrical halves which are clamped together by a self-locking band. Flanges or sockets are made as desired.

To mold a length of pipe one of the cylindrical molds is set up concentric with the ring. The mandrel is then lowered into it until the helical thread is nearly in contact with the bottom ring. Enough cement to form the pipe socket

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is then placed inside the mold and the mandrel is rotated by means of gearing. The effect of this rotation is to cause the helical thread to force the cement downward and fill the socket. The rotation is then continued, more cement being added at intervals and the mandrel being gradually moved upward, until the mold is filled to the top. The mandrel is then withdrawn from the mold and the latter with its contents and base plate is by means of an especial form of car removed to the store-room, where the iron foot of the mold is exchanged for a wooden one. This done, the pipe is placed upright and the mold taken away whilst the pipe is left to harden.

The capacity of one machine is stated to be as follows per hour:

6	9	12	15	18	20	24	Inches.
10	11	8	7	5	5	4	Pieces 3 ft. long

The pipes made by this machine are very smooth internally, and being molded under pressure, the concrete after hardening is very strong. The figures in the accompanying table below represent the breaking loads on pipes of different sizes, three months old. These tests were made by Dr. Toepffer, Finkenwalde, Germany. The pipes were laid flat and loaded on the upper surface.

Table showing results of tests of cement pipe, 3.28 feet long and of various diameters:

Composition of Mortar.			Diameter inside.	Thickness.	Breaking load.
Cement.	Sand.	Small stones.			
			Inch.	Inch.	Lbs.
1	3	.....	7.87	1.03	6,455
1	3	.....	9.84	1.10	6,305
1	2	1	9.84	1.10	7,059
1	1½	1½	9.84	1.10	5,855
1	1	2	9.84	1.10	5,324
1	3	1	9.84	1.10	5,789
1	3	.....	11.02	1.18	5,216
1	4	.....	11.02	1.18	5,027
1	3	.....	19.78	1.57	5,247

Other tests made by the Royal Technical Academy, Stockholm, Sweden, showed that the cement pipes were stronger than those of glazed earthenware pipes. The water level had sunk 23mm. in the cement pipes and 150mm. in the earthenware pipes.

Art Stone.

The first book written on the artificial stone and hollow concrete building block subject makes its appearance Jan. 1. It was written by F. W. Hagloch, Rose Building, Cleveland O., and gives plain instructions in easily understood language for the making of artificial stone and hollow concrete blocks in all its uses. It also gives much information as to making colored artificial stone ornaments of all kinds. The author is a practical civil engineer who has devoted many years to the subject of concrete and in recent years has devoted his entire time to the artificial stone industry. In this work he describes all hand and machine methods and has taken great care in describing every detail so that, he believes, any one of common school education and ordinary mechanical ability can by use of this book make all kinds of artificial stone successfully, special attention being given to the materials and devices most suitable for this line of work. A catechism of over 100 questions and answers gives a full review of the subject. The appendix consists of a glossary defining the unfamiliar terms used by the trade. It is an instructor for the beginner and a ready help for the most experienced. It is neatly bound in cloth and can be had by sending $1.50 to the author.

Trade Publications.

Jeffrey coal washing machinery is shown in catalogue 52 of the Jeffrey Mfg. Co. of Columbus, O.

Jeffrey Screening Machinery is illustrated and described in catalogue 69 of the Jeffrey Manufacturing Company, of Columbus, O.

The Cement Machinery Company, Jackson, Mich., sends a large card illustrating and describing the new 32-inch Normandin concrete block machine.

Circular No. 73 of the Jeffrey Manufacturing Company, Columbus, O., gives a general illustrated list of the various manufactures of this company in pocket book form handy for consultation.

The Engineering Company of America,

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The Medina Quarry Company, 150 Nassau-st., New York, issue "to architects, contractors, owners, and other interested persons" a handsomely illustrated booklet describing the product of their quarries at Albion, New York, and its use in buildings and pavements.

Julian Scholl & Co., 126 Liberty-st., New York, issue a catalogue of their Reliance steel stone crushers and portable stone crushing plants, including folding elevator, revolving screens, portable bins and road-roller or other portable engine.

Trade Notes.

ASPHALT.

The Ada Asphalt Company, Ada, Ind. Ter., is developing asphalt fields at that place.

The asphalt plant of Brayer Bros. near the city limits of Auburn, N. Y., was destroyed by fire Dec. 18.

A fire in the plant of the Barber Asphalt Paving Company at Long Island City Nov. 26 caused a loss of about $500.

The purchase of an asphalt plant to repair the asphalt streets in Allegheny, Pa., is recommended by E. J. McIlvain, director of public works.

The Boston Oil and Asphalt Company, Washington, D. C., has been incorporated by R. S. Donaldson, E. W. McCormick and James F. Shepperson.

A two-foot vein of asphalt was found recently on U. G. Leevey's farm near Robinson, Kas., while digging a well. Samples have been submitted for analysis and if a favorable report is rendered the deposits will be developed.

Capitalists of Beaumont, Tex., will develop asphalt deposits in the Wolf Creek valley in Pike County, Arkansas. J. E. Blackburn, president of the Texas Crude Oil and Mining Company, Beaumont, has secured 1,500 acres in fee simple, a lease on 1,000 more acres and an option on 30,000 which are supposed to contain one of the finest beds of asphalt in the country.

An attachment was served on the Federal Asphalt Company at Black Rock, Grayson County, Ky., Dec. 3. The attachment was sworn out by the Central Coal and Iron Company at Central City for $1,053. The Federal Asphalt Company was incorporated in West Virginia. Its mines are located three miles from Big Clifty. Another attachment for $4,800 has been sued for at Ft. Wayne, Ind. President Coffeen has not yet made a statement of the affairs of the company, but promises to do so in a few days.

BRICK.

The clay at Oak Park, Minn., is adapted to the manufacture of paving brick, according to press reports, and a plant will be established.

The Clarinda Mining and Manufacturing Company, Clarinda, Ia., will erect a plant and engage in the manufacture of pressed and paving brick.

The erection of a large paving brick plant at New Albany, is contemplated by McCann, Fitch & Converse of Chicago, Ill.

The Staten Island Brick and Tile Manufacturing Company, Washington, D. C., has been incorporated by George Lodge, Walter Bevans and Charles M. MacGowan.

Ike A. Chase, Memphis, Tenn., desires to correspond with parties who would be interested in a site for the establishment of a fire brick and sewer pipe plant.

H. Huennekes & Company, 114 Liberty-st., New York, show many highly commendatory letters from those who have purchased plants of them and those who have investigated the qualities of their product, sand lime brick.

CEMENT.

The Consumers' Gypsum Company, Port Clinton, O., has been incorporated.

The plant of the Aetna Cement Company, Fenton, Mich., is being improved.

The Cumberland Cement and Paving Company, Cumberland City, Tenn., has been incorporated.

Plans are being discussed by the Directors at Detroit, Mich., for reorganizing the Hecla Portland Cement Company.

The construction of immense Cement works near Laverty, Indian Territory, 10 mls. west of Chickasha, is contemplated.

Balfour, Guthrie & Company, of London, will engage in the manufacture of cement near Whatcom, Wash., according to press reports.

The Galveston, Houston & Northern delivered to W. L. Macatee & Sons of Houston, Tex., Jan. 11, 8,000 sacks of cement of 95 pounds each.

The Carbutt Gypsum Company, Rochester, N. Y., has been incorporated to mine gypsum, by John D. Lynn, Smith O'Brien and Carroll A. Thompson.

The National Portland Cement Company, First National Bank building, Easton, Pa., will have a new 16-kiln plant in operation in the spring.

The Wyandotte Cement Company has been incorporated by George B. Morely, of Saginaw; Standford T. Crapo, John B. Ford, Harry J. Baxton and Benjamin F. Berry of Detroit.

The Redfield Cement, Brick & Tile Manufacturing Company, Redfield, S. D., has its new machinery in running order and will begin making cement bricks and building blocks in the spring.

A Boston company has purchased of Hon. J. F. Wilkhouse of Orvillo, Ala., cement rights on 1,000 acres of land at West Dallas, Ala. and will erect a large plant for manufacturing Portland cement.

The plant of the Ft. Scott Hydraulic Cement Company, Ft. Scott, Kas., was entirely destroyed by fire Dec. 11. The plant was principally owned by Walter Halliwell and D. P. Thomas of Kansas City.

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The plants of the Glens Falls Portland Cement Company, with the exception of one have been closed for a short time on account of a fire.

The Bronson Portland Cement Company, Bronson, Mich., has been closed for the purpose of being put in good condition for an early renewal of business.

Valuable beds of cement extending over an area of several miles square and directly adjoining Anadarko, O. T., have been located, according to press reports from Andarko.

The Bronson Portland Cement Company has acquired some of the property of the Kalamazoo Cement Company, Kalamazoo, Mich. The company has also increased its capital stock from $500,000 to $1,000,000.

P. F. Haley and G. G. Hough, managers of the Bridger coal mine, Bridger, Mont., have found another deposit of gypsum one and one-fourth miles from the railroad. Where exposed the ledge is eight feet thick.

The Gypsum fields around Watonga, Ok., are pronounced by G. P. Grimsby, secretary of the Kansas Academy of Science, among the richest in the United States. Mr. Grimsby has been investigating the deposits for Oklahoma City and El Reno investors.

The repairs being made to the plant of the Alpena Portland Cement Company, Alpena, Mich., will be completed early in January. At a recent meeting of the directors they unanimously voted to change from the wet to the dry process, which will require about three and a half months and will cost between $50,000 and $60,000. Herman Besser, president.

The Standard Portland Cement Company, Detroit, Mich., filed amended articles of association Nov. 27, converting $300,000 of common stock into preferred stock. The company is building a railroad from its property in Benzie County to Lake Michigan, where it has a large pier. The construction of the plant will be commenced in the spring. Fred H. Aldrich, secretary.

The Consolidated Cement Company has made a proposition to the county board at Milwaukee, Wis., to sell its Whitefish Bay property for prison use. The Whitefish Bay property consists of 75½ acres and is fully equipped with all the improvements necessary for furnishing an output of 1,000 barrels a day. W. Bollow, agent.

The Kentucky Portland Cement Company, of Delaware, has been reorganized by Detroit capitalists who have taken over the holdings of the company and will begin at once the construction of a large cement plant at Marengo, Ind. Congressman F. L. Wheeler is president and John Lokie is secretary and treasurer of the new company. Both gentlemen are residents of Detroit. The Kentucky Portland Cement Company was organized in Louisville, Ky., in 1902 with C. J. Meddin as president and C. B. Nordeman as secretary and treasurer. Plans for a plant at Marengo will be made at once by C. H. Todge. The new company will be known as the Marengo Portland Cement Company.

The Wentz Engineering Company of Nazareth, Pa., will begin Jan. 2, the construction of a 1,000-barrel cement plant at Edgewater, Benzie County, Mich., for the Standard Portland Cement Company. The Standard Portland Cement Company is composed of F. H. Aldrich, 813 Hammond Building, Detroit; S. C. Symons, Saginaw; Wm. J. Cornwell, Cadillac; Edwin Fellows, Frankfort.

The Cement Tile Works, Sac City, Ia., is manufacturing drain tile out of cement concrete and will manufacture building blocks after molding dies invented by C. S. Larimer, manager of the company. The company will engage in sidewalk construction and will retail cement. A steam heat plant has been put in and operations will continue during winter and summer. The officers of the company are: President, George Glass; manager C. S. Larimer; secretary, Henry Barent.

U. R. Loranger, former secretary and manager of the Hecla Portland Cement & Coal Company, Bay City, Mich., filed in the United States Court Dec. 9, a sworn petition asking the court to permit him to intervene in the foreclosure suit brought against the Hecla Company by the Detroit Trust Company. The former secretary claims that the company's troubles are the result of a deliberate attempt to wreck the company in order that the properties might be secured at less than their actual value, he and others being principal creditors.

The Cement Workers and Helpers' Union at Springfield, Ill., has elected officers for the ensuing six months as follows: President, W. Fifield (re-elected); vice-president, Joe Bostick; recording secretary, Clifford Fifield (re-elected); financial secretary, Alfred Overton (re-elected); treasurer, George Sifkin; warden, Pete Duffy; guide, Noah Roe. Trustees—C. Fifield, R. Lovejoy, F. McInern. Delegates to S. F. of Labor—W. Fifield, R. Lovejoy, C. Fifield. This is the fourth consecutive term that Clifford Fifield, the present recording secretary, has been unanimously elected to office.

The Alma Cement Company, which purchased the property of the Alma Portland Cement Company at Wellston, O., is rebuilding the plant and will be ready for operation about Jan. 1, 1903. The company does not expect to place cement on the market before March 1, however, as it desires its product to be properly aged before it goes out. The company's offices are in the Betz Building, Philadelphia, and its officers are as follows: President, B. B. Lathbury; vice-president, Frederick Strauss; secretary and treasurer, Mark T. Cox. William J. Donaldson in charge of sales department.

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LIGHTING AND POWER.

The McClure Lighting Company, Minneapolis, Minn., has been incorporated by F. D. Clark, Edward Stump and W. M. Bruger.

The General Lighting Supply Company, Philadelphia, Pa., has been incorporated to furnish light, heat and uower and manufacture and sell lighting supplies.

The American Gas Machine Company, Albert Lea, Minn., has been incorporated by Ferdinand Larson, N. P. Christenson, J. P. Jensen, C. A. Ranson, Edward Olson, Geo. Hurd, E. W. Knatvold and others, all of Albert Lea.

The Saginaw United Electric Company and Bay City United Electric Company have been capitalized by Philadelphia capitalists, who will engage in electric lighting.

The Allgemeine and Union Elektricitats companies, Berlin, Germany, decided Dec. 5, to consolidate. The Union Company's 24,000,000 shares will be transformed into 16,000.000 shares of the Allemeine, making the capital of the latter $19,000,000.

A merger of electric and power plants in the coke regions and the Pittsburg, McKeesport & Connellsville railway system has been effected and applications for a charter for the combined interests will be made at Harrisburg, Dec. 31. The new company will be known as the Western Pennsylvania Railroad Company and will be in control of the entire lighting, power and street railway systems of Westmoreland and Fayette Counties and part of the trolley system of Allegheny County.

MISCELLANEOUS.

The works of the American Bridge Company at Ambridge, Pa., will be started Jan. 4.

The Plymouth Paving Co., Minneapolis, Minn., will manufacture sidewalk blocks this winter at Aitken, Minn.

One of the largest stone crushing plants in southern Minnesota has recently been completed by Fowler & Pay of Mankato, Minn.

The Canton Concrete Company, Canton, O., has been incorporated by J. N. McQueen, Peter Schisler, P. H. Weber, John Floom and A. O. Stentz.

The Pleasant Hill Sewer Company, Tupper Lake, N. Y., has been incorporated by Louis De Laucett, W. J. Devendorf and Barney Seigel of Tupper Lake.

The Nashville Roofing & Paving Company of Nashville, Tenn., will build a plant at Birmingham, Ala., for the manufacture of bituminous macadam.

The Wagner Stone Company, Sandusky, O., has been incorporated by Michael Wagner, Leo E. Wagner, Albert E. Wagner. Emil W. Wagner and Joseph F. Wagner.

The Ohio Paving Company has been incorporated at Indianapolis, acknowledging to interests in Indiana worth $5,000. John Kerlin, Montpelier, Ind., state representative.

The Powers Manufacturing Company, Clarinda, Ia., has been incorporated to manufacture well-boring and rock-drilling machinery and general well and water supply tools.

The Building Block Manufacturing Company, Minneapolis, Minn., has erected a large plant near Lake Calhoun for the manufacture of hollow concrete blocks for structural purposes.

Lewinson & Just, 452 Fifth-ave., New York City, have dissolved partnership and George A. Just will conduct the business of consulting and contracting engineers under the firm name of George A. Just & Co.

C. M. and John J. Murphy, formerly of the Fuller Construction Company have organized and incorporated the Murphy Construction Company, with offices at 112 and 114 W. Forty-third-st., New York City.

The Howard Hydraulic Cement Company,, Cement, Ga., desires to correspond with tile companies or parties who make tile for sidewalks, etc. Also with parties making tools for this walk. J. H. Warner, prest. & treas.

Mayer Bros., Mankato, Minn., have been incorporated to manufacture trip hammers, boilers, gasoline and steam engines, structural steel and iron, etc., with officers as follows: President, Louis Mayer; vice-president, H. F. Mayer; secretary and treasurer, Lorenz L. Mayer.

Mr. W. N. Thornburg has been elected vice-president of the Ohio Quarries Company. His offices will be in the Marquette building, 204 Dearborn-st., Chicago. Mr. Thornburgh has been connected with the sandstone trade for many years.

The Altoona Concrete Construction & Supply Company of Butler, Pa., has been incorporated under Delaware laws to manufacture the H. S. Palmer hollow concrete building block and Cochrane cement sand brick. The incorporators are Chas. C. Reeder, Butler, Pa.; S. P. Zetui-

Mr. F. S. Dickinson has been appointed sales agent of the Bedford Quarries Company with offices in the Flatiron building, 949 Broadway, New York City. Mr. Dickinson will have charge of the eastern sales of this company, which is the largest producer of Oolitic limestone in the world.

J. W. Sanderson of the Normandin Cement Building Block Machinery Company, Burlington, Ia., has sold cement block machines as follows: A company at Cedar Rapids, Ia., composed of William King, T. C. Munger and J. W. Sanderson; to Roney & Sheehan of Independence, Ia.; to Webster Cement Products Company, Webster City, Ia.; Rockford Concrete Construction Company, Rockford, Ill.; company at Oskaloosa, Ia., composed of G. H. Carlon & Sons and G. H. Carlon; Chris Riemer & Co., Marshalltown, Ia. The Normandin Cement block machine is in operation in 22 plants in Iowa.

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The Buffalo Litholite Company has been incorporated to manufacture an artificial stone invented by C. W. Stevens of Harvey, Ill. The officers of the company are: President, Uriah Cummings, Akron, N. Y.; vice-president, Chas. H. Lockard, Syracuse; secretary and treasurer, Chas. Barnum, Buffalo.

Lewinson & Co. was recently incorporated with offices at 128 W. Forty-second-st., New York City, to conduct business as consulting engineers and contractors. MacMillan Lewinson, who is president of the company, has been, for a number of years a member of the recently dissolved firm of Lewinson & Just. D. B. Richardson is secretary and treasurer of the company.

"We pull for Leschens" is what you read on the large leather collars of the horses attached to the wagons of A. Leschen & Sons Rope Company in St. Louis, New York, Chicago and Denver. These are the wagons in which they deliver their reels and coils of Hercules and patent flattened strand and all other kinds of wire rope. A. Leschen & Sons Rope Company also manufactures and erects aerial wire rope tramways of every description; likewise underground and surface wire rope haulage plants. Their engineers in charge of the different departments have had years of experience and are thoroughly competent. 920 to 932 N. First-st., St. Louis, Mo., is the home office of A. Leschen & Sons Rope Company.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Davenport, Ia.—The Allen Paving case will come up on appeal in the United States Circuit Court on Jan. 11.

St. Joseph, Mo.—A sample block of paving will be constructed on Eighth-st., between Felix and Francis-sts., by Rackliffe & Gibson, using Purington block, which is manufactured at Galesburg, Ill.

Akron, O.—The property owners on Rhodes-ave. have been granted an injunction restraining the County Treasurer from collecting the assessments for improving that street, or the sale of their property as delinquents on their refusal to pay. They claim that the resolution providing for the improvement was illegal.

CONTEMPLATED WORK.

Frankford, Pa.—Paving is contemplated for various streets.

Hazleton, Pa.—An ordinance has been passed to pave Wyoming-st.

Scranton, Pa.—Cedar-ave. will be paved. Aleck T. Connell, mayor.

Pasadena, Cal.—Marengo-ave. will be paved its entire length, 2¼ miles.

Boston, Mass.—The question of widen-

New York City—The property owners on lower Park-row have petitioned for asphalt paving.

Albany, N. Y.—An ordinance has been approved by Mayor Gaus for paving Sherman-st. with asphalt.

Dallas, Tex.—The Dallas county comrs. will engage a civil engineer to prepare plans for county roads.

Nashua, N. H.—The bd. of pub. wks. contemplates paving Main-st., from City Hall to the Worcester tracks.

Fairview, Mich.—This village voted Dec. 12 to issue $36,000 bonds for paving, sewers and water mains.

Houghton, Mich.—(Special.)—W. V. Sacicki, vil. engr., says this village contemplates paving Sheldon-st.

Newport News, Va.—A bill has passed the Senate approving the issue of $56,000 bonds for street pavements.

Cedar Rapids, Ia.—The city council is considering a petition for the improvement of the Welchheimer road.

Los Angeles, Cal.—Petitions have been submitted to the city council asking for about 4 mls. of asphalt paving.

Little Falls, N. Y.—The question of paving all the principal streets is being considered. Cy. Engr. Lansing.

Walla Walla, Wash.—The necessity of

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Hays, Kas.—An ordinance has been approved for constructing sidewalks on various streets. W. H. Cakrick, cy. clk.

Atlanta, Ga.—The question of paving Marietta-ave., from Peach Tree-st. to a point near the government building with asphalt is under discussion.

Paris, Ill—Ordinances will be passed in January for paving S. Central, N. Central and Prairie-sts. Cy. Engr. Sawyer.

Mobile, Ala.—The board of public works will present the plan for the third paving contract to the general Council during January.

Atchison, Kas.—A resolution has been passed to pave 7,800 square yards of Parallel-st. with brick. Fred Giddings, cy. engr.

Atlantic City, N. J.—The property-owners on Iowa-ave., from Pacific to Arctic-aves., have petitioned for asphalt or bituiithic pavement.

New York City—The board of estimates appropriated $1,750,000 for the completion of the Riverside Drive extension, One Hundred and Thirty-fifth to One Hundred and Fifty-fifth-sts.

Philadelphia, Pa.—A boulevard from City Hall to the Green-st. entrance to Park is proposed. Macadam or asphalt paving will be used.

Marshalltown, Ia.—A resolution will be considered by the City Council Jan. 4 providing for paving Second, Third, Fourth and Fifth-sts., six blocks.

Greece, N. Y.—The town board has decided to construct about 6 miles of roads. Bids will be asked as soon as plans and specifications can be prepared.

Rushville, Ind.—The county commissioners have approved the report of the viewers for constructing 12 mls. of the Gowdy, Moscow and St. Paul pike.

Akron, O.—Ordinances have been approved for paving Upson and Locust-sts. with brick, and macadamizing South and Bill-sts. Chas. W. Kempel, mayor.

Decatur, Ind.—A petition has been submitted to the county auditor asking for the construction of a macadam road in Monroe township. Abe Boch, co. audt.

Frankfort, Ind.—About 20 mls. of new gravel roads will be built, as a result of the recent decision of the Supreme Court holding the gravel law to be constitutional.

Norwood, O.—Resolutions have been passed by the city council providing for the construction of macadam paving on Lawrence and Walton-aves. John Meyer, prest. cy. coun.

Washington, Ia.—A resolution was approved Dec. 7 for paving Iowa, Marion, Main and Washington-sts. with brick blocks. Objections will be heard Jan. 6. A. N. Alberson, mayor.

supvrs. to construct a state road 2 mls. long from Stottsville to this place, and one 1-mi long from Chatham to Chatham Center.

Ashland, Wis.—The committee appointed by Mayor Williams to report upon street improvements for next year favor macadam paving for W. Second and Third-sts. and Prentice and Vaughn-aves. with asphalt for Seventh and Ellis-aves. and Second-st.

CONTRACTS TO BE LET.

Ottawa, O.—Bids are asked until Jan. 28 for 7½ miles of stone road work. O. C. Talbot, co. surv.

Paoli, Ind.—Bids are asked until Jan. 5 for building 37 mls. and 1,548 ft. of road. Geo. W. Tegarden, co. audt.

Cleveland, O.—Bids are asked until Jan. 6 for paving a number of streets with asphalt. A. R. Callow, sec'y B. P. S.

Lafayette, Ind.—Bids are asked until 10 a. m. Jan. 11 for constructing the E. B. Steeley et al. gravel road. Bd. comrs.

Le Mars, Ia.—Bids are asked until Jan. 16 for paving Sixth, Seventh and Main-sts. with vitrified brick. O. L. Loudenslager, clk.

Houston, Tex.—Sealed bids are asked until 12 m. Jan. 4 for constructing 32 mls. of gravel pavements. O. T. Holt, mayor; D. D. Bryan, secy.

Omaha, Neb.—Bids are asked until Jan. 22, according to local press reports, for building permanent sidewalks and for grading Fifteenth-st. and an alley.

Cincinnati, O.—Sealed bids are asked until Jan. 14 for paving McMillan-st. from May-st. to Auburn-ave. with asphalt. Geo. F. Holmes, clk. B. P. S.

Toms River, N. J.—Sealed bids are asked until Feb. 9 for building a gravel road in Union twp. 3.25 miles in length. Jas. E. Otis, dir. bd. freeholders.

New London, Conn.—Bids are asked until Jan. 14 for constructing a macadamized road between Ft. Mansfield and Watch Hill, R. I. Address Q. M., 27 Granite-st.

Bloomfield, Ind.—Bids are asked until 1 p. m., Jan. 5, for building 2 mls. of gravel roads in Smith twp. and ½ mi. of gravel road in Center twp. Bd. comrs.

Sullivan, Ind.—Sealed bids are asked until 11 a. m., Jan. 4, for building 4 mls. of stone roads in Haddon twp. Joseph Asbury, chmn. bd. comrs.; J. M. Lang, co. audt.

Port Townsend, Wash.—Bids are asked until Jan. 13, for building granolithic walks as approaches to buildings at Forts Worden and Casey. Geo. H. Penrose, Q. M., U. S. A.

Columbus, Ind.—Sealed bids are asked until Jan. 7 for 9,325 sq. yds. of brick paving on Washington-st., and 7,000 sq. yds. on Fifth-st. W. H. Rights, cy. engr.;

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Crookston, Minn.—Sealed bids are asked until 8 p. m., Jan. 12, for granite macadam paving, granite or sandstone curbing and granolithic gutter on Broadway, Main, Fletcher and Third-sts. W. H. Graver, cy. clk.

Belleville, Ill.—Sealed bids are asked until Jan. 20, 1904, for paving W. Main and S. Illinois-sts. with brick, with stone curbing; paving Race, Second and Third-sts. with asphalt, with combined granitoid curb and gutter. Fred J. Kern, prest. B. L. I.

Toledo, O.—Bids are asked until Jan. 4, for brick paving as follows: John-st., 547 sq. yds.; Ostrich Lane, 1,005 sq. yds.; Prouty-ave., 1,650 sq. yds. Bids are asked until Jan. 18 for 1,690 sq. yds. of brick paving on Elm-st., and 5,930 sq. yds. on Auburn-ave. Harry S. Jones, secy. B. P. S.

CONTRACTS AWARDED.

Ardmore, I. T.—The contract for paving Main-st. with asphalt was awarded to J. S. Downard.

Cincinnati, O.—The contract for paving Fourth-st. with asphalt was awarded to the Kirchner Construction Company.

Atlanta, Ga.—The contract for paving N. Pryor-st., from Peachtree to Alabama, with asphalt, was awarded to Venable Bros.

Springfield, Mass.—The contract for constructing the Depot road was awarded to John Polcaro of Pittsfield for $22,638.

Chester, Pa.—W. E. Reilly was awarded the contract for relaying the sidewalks on Fifth and Lloyd-sts. at 55 cents a sq. yd.

Far Hills, N. Y.—The contract for macadam paving to the Morris county line was awarded to Augustus Munson & Company for $22,808.

Lexington, Mo.—The contract for paving Main-st., from Eighth to Thirteenth, was awarded, Dec. 16, to the Ft. Scott Stone & Const. Company for $1.74 a sq. yd.

St. Paul, Minn.—The contract for macadam paving on W. Seventh-st., from Tuscarora to Fort Snelling was awarded to Fielding & Shepley for $69,872.

Benton Harbor, Mich. — The Cleveland Asphalt and Paving Company, Cleveland, O., was awarded the contract for paving three streets at $1.87 a sq. yd.

Salt Lake City, Utah.—Paving contracts were awarded Dec. 13 as follows: E. First South-st., J. P. Moran, $21,711.25; cement sidewalks, R. S. Blome Company of Chicago, $29,596.

Bound Brook, N. J.—Bids have been received for macadam paving on Mountain-Holloway, 8.3 cts. a sq. ft.; Grading, curb and gutter in Carlton-ave., Charles Mushrush, 65 cts. a cu. yd. for grading, 20 cts. a lin. ft. for curb and 13 cts. for gutter. Pleasant-st., E. J. Hart, sidewalks, 8.25 cts.; grading, 29 cts.; curb, 20 cts. and gutter, 13 cts.

Kansas City, Mo.—The contract for resurfacing Westport-ave. from Main-st. to Shawnee-ave., was awarded to the Barber Asphalt Paving Company at $1.85 a sq. yd. Other contracts for asphalt paving were awarded as follows: 40th-st., from Main to Oak, Parker-Washington Company, $7,243.35; 23d st., from Indiana to Cleveland, Gilsonite Company, $10,225.40; brick sidewalk, 25th-st., from Michigan to Cleveland, Missouri Sidewalk Company, $284.70; curbing Locust-st., from 20th-st. to Belt line tracks, Kansas City Sidewalk Company, $185.25.

Buffalo, N. Y.—Bids have been received for paving as follows: Repaving Walden-ave., German Rock Asphalt Company, asphalt, $12,065; paving Hartman-place, Eastern Construction Company, asphalt, $6,300. F. V. E. Bardol bid the same sum for brick; repaving Tonawanda-st., German Rock Asphalt Company, asphalt, $36,042; L. H. Gipp, brick, $30,500.

Cadillac, Mich.—Bids were submitted Dec. 8 for paving the principal streets as follows: Cleveland Trinidad Asphalt Company of Ohio, asphalt, 10-year guarantee, $33,020; Central Bitulithic Company of Detroit, bitulithic, 10-year, $34,785; 5-year, $32,433; Barber Asphalt Paving Company, Detroit, bitulithic, 10-year, $32,666; Trinidad, 10-year, $32,500; Trinidad Lake asphalt, 10-year, $33,233; A. Prange, Grand Rapids, Canton brick, 10-year, $31,686; Dean & Connors, Albion, Mich., 10-year, $31,214; 5-year, $30,976.

Philadelphia, Pa.—Bids were received Dec. 17 for repairing streets, maintaining macadamized roads, etc., as follows: Repair streets, except asphalt and granolithic, Mack Paving Company, $144,200. Maintaining macadamized and improved roads, David Peoples, $175,000; Edward H. Vare, $122,000; David McMahon, $130,000; James R. Shanley, $170,000. For resurfacing macadamized roads with broken stone, David McMahon, 91 cents per square yard; Edward H. Vare, 80 cents; David Peoples, 95 cents, and James R. Shanley, 90 cents.

Syracuse, N. Y.—Bids have been submitted for paving S. Salina-st. as follows: John W. Bustin, 405 W. Onondaga-st., Syracuse brick, $22,370;, and sandstone between railway tracks, $24.-

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sandstone between tracks, $26,003; Empire Contracting Company, 112 E. Jefferson-st., Trinidad asphalt, $23,921, and sandstone between tracks, $27,177.

SEWERS.

Columbus, O.—Mayor Jeffrey is opposed to the expenditure of $50,000 for the construction of a temporary or experimental sewage disposal plant.

CONTEMPLATED WORK.

Evansville, Ind.—A main sewer is contemplated.

Marden Rock, Wis.—Plans for a sewer are under consideration.

Chambersburg, Pa.—A 24-in. pipe sewer to the creek is proposed.

Croton, Conn.—The question of sewage disposal is being discussed.

Hutchinson, Kas.—The extension of the sewerage system is contemplated.

Fairview, Mich.—This village voted to issue bonds for building sewers.

Lambertsville, N. J.—The construction of a system of sewers is contemplated.

Menasha, Wis.—A sewer in Manitowoc-st. is contemplated. S. S. Little, cy. clk.

Rockford, Ill.—The city engineer is preparing plans for a new sewer in Prairie-st.

Red Wing, Minn.—Plans have been decided upon for a sewerage system in East Red Wing.

Ft. Wayne, Ind.—A resolution has been adopted for a system of sewers in South Wayne territory.

Houlton, Me.—An engineer will be engaged to make a survey for the extension of the sewerage system.

Fitchburg, Mass.—Plans have been prepared for building a sewerage system. David A. Hartwell, cy engr.

Belleville, Ill.—An ordinance has been adopted to build intercepting sewers and a septic tank. Mayor Kern.

Edwardsville, Ill.—Bids may be asked in February for constructing 20 to 30-in. pipe sewers and a septic tank.

Hagerstown, Md.—Mayor Holzappel, jr., advocates the construction of eight to ten underground drains to cost about $8,000.

Baltimore, Md.—The sewerage commission has finally placed the cost of the proposed sewerage system at $12,000,000.

Grand Rapids, Mich.—Estimates have been prepared for building sewers in Baldwin and N. Union-sts. and Ellsworth and Morris-aves.

Binghamton, N. Y.—S. E. Monroe, cy. engr., estimates the cost of the proposed Fourth Ward trunk sewer at $35,000 without the laterals.

[illegible] will be asked for the construction of a trunk sewer in Noble-ave. and the extension of the trunk sewer in Main-st.

Niagara Falls, N. Y.—A sewer is proposed from the disposal works in Echota to the tunnel trunk sewer. Bids will be asked for building a sewer in Beech-ave.

Buffalo, N. Y.—The Business Men and Taxpayers' Association of West Seneca has appointed a committee to report on the matter of installing a modern sewerage system.

Janesville, Wis.—The special committee has recommended the construction of sewers and storm sewers in a large number of streets on the west side of the river.

Johnstown, Pa.—Resolutions have been introduced providing for a trunk sewer to take care of the first, second and third ward sewage and for a permanent sewerage system.

Sebring, O.—Plans have been accepted for the proposed sewerage system. Plans and specifications for a new sewage disposal plant will be submitted to the State Board of Health.

Hyattsville, Md.—A preliminary survey of the town is being made by T. Chalkley Hatton of Wilmington, Del., preparatory to making estimates of the cost of installing a sewerage system.

The construction of sewerage systems is contemplated at the following places: Coldwater, Mich.; Saxonville, Mass.; Lakeville, Conn.; Newton, N. J.; Bennettsville, S. C.; Louisiana, Mo.; Santiago, Chili.

CONTRACTS TO BE LET.

Clinton, Ia.—Bids are asked until Jan. 12 for 5360 ft. of brick sewer. H. E. Oates, clk.

Crookston, Minn.—Bids are asked until Jan. 8 for constructing ditch No. 49. N. A. Hoffard, co. audt.

Cannelton, Ind.—Bids are asked until 10 a. m. Jan. 4 for constructing a public ditch. Bd. co. comrs.

Alexandria, Minn.—Bids are asked until Jan 11 for constructing ditch No. 3. E. P. Wright, co. audt.

Vinita, Ind. Ter.—Bids are asked until Jan. 5 for building a sewerage system. F. J. Barrett, recorder.

Anderson, Ind.—Bids are asked until Jan. 2 for constructing 7 mls. of open ditch. Morton H. Downey, co. surv.

Decatur, Ind.—Sealed bids are asked until 7 p. m. Jan. 5 for a 10 in. tile sewer in Marshall-st. D. M. Hower, cy. clk.

St. Paul, Minn.—Bids are asked until 2 p. m., Jan. 4 for building a sewer on Fairfield-ave. from Wabash to Custer-

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Hawkinsville, Ga.—Sealed bids are asked until Jan. 21 for furnished and laying 19,500 feet of 6 to 15-in. sewer pipe, 50 manholes and 10 flush tanks. T. J. Holder, cy. clk.

Omaha, Neb.—Bids are asked, according to press reports, for constructing the Saddle Creek sewer, from Hamilton to California-sts. and sewers in Lincoln-ave. and Thirteenth and Cass-sts.

New Orleans, La.—Sealed bids are asked until Feb. 2 for constructing 66 mls. of sewers and appurtenances, including 700 manholes and 500 flush tanks. F. S. Shields secy. sewerage and water bd.

CONTRACTS AWARDED.

Tacoma, Wash.—Carlson & Swanson secured the contract Dec. 15 for building sewers in dist. No. 23 for $2,925.

Wabash, Ind.—The contract for constructing a ditch 7 mls. long was awarded to A. M. Jones of Syracuse for $10,000.

Burlington, Ia.—The contract for building the Hawkeye sewer was awarded to the Burlington Const. Company for $20,000.

Oakland, Cal.—The contract for building a main outlet sewer was awarded to E. B. & A.L. Stone for $136,511.10.

Kansas City, Mo.—The contract for constructing a sewer in district 218 was awarded to W. C. Mullins for $204,812.83.

Salt Lake City, Utah—The contract for constructing sewers was awarded Dec. 12 to Jas. Kennedy & Co. of Fargo, N. D., for $18,801.

Easton, Pa.—The contract for building a sewer from Second-st. to the Delaware river was awarded to John McQuerney, city, for $2,516.

National Park, N. J.—The contract for constructing sewerage system was awarded Dec. 1 to H. A. Miller of Wilmington for $5,387.54.

Steubenville, O.—John O. Bates was awarded the contract for building a 20-in. sewer on S. Seventh-st., from South to Slack-sts., for $1,488.80.

Greensboro, N. C.—The contract for building 13½ mls. of lateral sewers was awarded to Guild & Co. of Chattanooga, Tenn., for $34,529.

Harrisburg, Pa.—Henry Opperman was the lowest bidder, Dec. 19, for constructing the Second-st. sewer extension from Muench to Kelker for $671.

Saginaw, Mich.—Sewer contracts have been awarded as follows: State-st., from Merchon to Bay-sts., Z. & J. Lalonde; Mackinaw-st., from Center to Linden-sts., B. F. Brucker & Co.

Fremont, O.—Bids for building 1,100 ft. $25,000; Wm. H. Achuff, $16,900; Jas. M. West, $14,400; B. E. Minaghan, $15,875; David Peoples, $29,000.

East Syracuse, N. Y.—The contract for building a sewerage system was awarded, Dec. 4, as follows: South Section, M. O'Hearn & Co., Pittsburg, $22,686.30; north section, De Nallo & Klingsburg of Kingston, $24,562.20.

Mishawka, Ind.—The Elkhart Construction Company was awarded the contract, Dec. 7, for building Joseph-st. sewer No. 3 for $1,430.68. Fred Rankert was awarded the contract for the Calhoun, Charlotte and Joseph-st. trunk sewer for $22,539.96.

Guttenberg, N. J.—Bids for building the main outlet sewer have been submitted as follows: George Horung, $33,669; Robert J. Emmer, $37,338; Palisade Construction Company, Jersey City, $40,998.72; August Theit, $36,602; Capone & Frost, $35,022; Michael J. Curley, Jersey City, $40,267.

Milwaukee, Wis.—The contract for completing the Kinnickinnic river flushing tunnel was awarded Dec. 22 to R. J. Hickey at $38 a lin. ft. R. W. Forrestal, who had the contract for the complete work and was released from the contract, had completed all but 385 feet of the work.

St. Paul, Minn.—Edward J. Kirkland submitted the lowest bid Dec. 14 for constructing the first three-fourths mile of the St. Anthony Park sewer system. His bid aggregated $59,122, which was $500 less than the city engineer's estimate. The sewer will be built of brick and stone or concrete and steel.

Centralia, Ill.—The contract for constructing a sewerage system was awarded Dec. 10 to Engel & Carpenter of West Pullman, Chicago, for $38,283.18. The work consists of 23,920 ft. 8 in., 10,165 ft. 10 in., 7,205 ft. 12 in., 1,880 ft. 15 in. and 3,575 ft. 18 in. pipe sewers, 75 manholes and 21 flush tanks. Iowa Engineering Company, Clinton, Ia., Engrs. in charge.

WATER-WORKS.

Chicago, Ill.—George Mayer was appointed receiver of the East Chicago Water Works Company, Dec. 8, by Judge Kavanaugh.

Columbia, Mo.—The city council decided, Dec. 16, to purchase the water and light plant of the Columbia Water and Light Company.

Camden, N. J.—The Wilmington Water and Light Company has been incorpor-

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of the city's water supply. The water department has knowledge of about 500 cases of pollution, about 150 of which are technical, but not actual, inasmuch as they are within the limit set by law prohibiting the existence of nuisances near streams tributary to the water supply, and yet do not drain into the streams. Of the remaining number many consist of barnyards and pig pens and about 100 nuisances, all due to dwellings.

Indianapolis, Ind.—Suit was brought in the Federal court Dec. 17 by Frank H. Cooper of New York City, asking for a receiver for the Lake City Water Company, at Hammond, Ind., and asking for an injunction against that city to prevent it from cutting the company's connection with the city's mains. He claims that the city owes the company $15,000 for water rentals and is arranging to cut off the company's mains and supply citizens with water from other sources. Mr. Cooper is owner of 50 bonds of an issue of $197,000 authorized by the city of Hammond in 1901 to build a water works system.

Bristol, Tenn.—A temporary injunction restraining this city from putting into effect the deal by which the city was to become owner of the water works of the Bristol-Goodson Water Company, the King and Preston Springs, was granted by Chancellor H. H. Haynes, Dec. 12. The city had closed deal for these properties at $112,500. The citizens seeking the injunction, stated in their petition to the court that the city has no legal right to purchase and operate the plant of another corporation; that the city has no right to contract for rights-of-way and to construct a pipe line in Virginia which would be necessary to reach the Preston Springs, the proposed source of supply; that the price agreed upon is exorbitant. The petitioners propose the purchase of the Bristol-Goodson water works at a lower price, and the construction of a pipe line to the Holston River at Damascus, a distance of 15 miles.

CONTEMPLATED WORK.

Newton, N. J.—A storage reservoir is proposed.

Springfield, O. — The extension of the water mains is proposed.

Marquette, Mich.—The extension of the intake pipe is proposed.

Waldron, Ind.—A company has been organized to build a water works.

Fairview, Mich.—The village voted to issue bonds for water mains.

Auburn, N. Y.—The Water Board has decided to lay about 5 mls. of water mains during 1904.

Lancaster, Pa.—A committee has been appointed to investigate and report on a filtration plant.

Sheboygan, Wis.—Plans are being made for municipal water works. George C. Morgan, Chicago, engr.

Harrisburg, Pa.—The contract for constructing the filter plant will probably be let in February.

Waltham, Mass. — The improvement of the water supply will be taken up by the new city government.

Downers Grove, Ill.—The water mains will be extended on Rogers and Elm-sts. and Prairie-ave.

The question of issuing water works bonds will be voted on at the following places: Waverly, Minn.; Caro, Mich.

Pueblo, Colo.—An ordinance has been passed providing for the issue of $150,000 bonds for the North Side water works.

Gadsden, Ala.—The question of the city owning and operating its own water works system will be voted on Jan. 4.

Houghton, Mich. (Special)—W. V. Savicki, vil. engr., says this village contemplates enlarging its water works system.

Rockford, Ill.—A revolution was passed Dec. 7 favoring the installation of water meters in many of the large buildings.

Nevada, Mo. (Special)—James M. Clack, cy. engr., says this city voted to issue $90,000 for a new municipal water plant.

The question of issuing water works bonds has been favorably voted on as follows: Cedar Bluffs, Neb.; Saugatuck, Mich.; Phoenix, Ariz.

Sayville, N. Y.—The establishment of water works is contemplated by the Sayville Electric Light Company in connection with its electric plant.

Shenandoah, Pa.—The question of increasing the borough debt $50,000 for securing a more plentiful water supply will be voted on in February.

Yankton, S. D.—The estimated cost of improving the water works system including a standpipe, filtration plant and new mains is $77,000.

Columbus, Ga.—J. L. Ludlow, cons. engr., Winston, N. C., has submitted estimate of the cost of water works for this city. T. E. Golden, chmn. water comrs.

Brockton, Mass.—An ordinance has been passed providing for a loan of $150,000 for completing the Silver Lake Water Supply system. Horace Kingman, supt. w. w.

Springfield, Mass.—Mayor Stone and the Board of Water Commissioners have petitioned the legislature for authority to secure a water supply from the Westfield river.

Wheeling, W. Va.—This city has authorized an expenditure of $75,000 for a new 30-in. supply main from the pumping station to the reservoir. C. B. Cooke, cy. engr.

Philadelphia, Pa.—The loan bill providing for a bond issue of $16,000,000 for filtration, sewers, bridges, paving, building, etc., has been passed over the mayor's veto.

Delphi, Ind.—Cy. engr. Shields recommends the plan of taking water from the mill race on Deer Creek and filtering it, as a means of securing an increased water supply.

La Crosse, Wis.—A plan has been

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formulated subject to the approval of the citizens, for the immediate construction of a filtration plant at a cost of $80,000 to $100,000.

Trenton, N. J.—The council finance committee contemplates employing an engineer to report upon the feasibility of auxiliary high pressure water mains for the center of this city.

Chehalis, Wash.—This city has purchased the plant of the Chehalis Water Company. A gravity water system and the improvement of the source of supply is now proposed. Francis Donahue, mayor.

The construction of water works systems is contemplated at the following places: Elberton, Ga.; Tahlequah, Ind. Ter.; Milo, Me.; Prospect, N. Y.; Garfield, N. J.; Winchester, Ill.; Murray, O.; Onawa, Ia.

CONTRACTS TO BE LET.

Hawkinsville, Ga.—Sealed bids are asked until Jan. 21 for a water works system. T. J. Holden, cy. clk.

New Orleans, La.—Sealed bids are asked until Feb. 2 for laying 2.7 mls. of water mains. F. S. Shields, secy. sewerage and water bd.

Ithaca, N. Y.—Bids are asked until Jan. 4 for constructing artesian wells to intake well at the pumping station. John Miller, secy. water bd.

Portland, Me.—Bids are asked until Jan. 22 for constructing a pumping and storage plant at Ft. McKinley, Me. Capt. A. W. Gates, Q. M. U. S. A.

San Antonio, Tex.—Bids are asked until Jan. 5 for the erection of a 50,000-gal. steel tank on 50 ft. trestle at Ft. Brown, Tex., T. E. True, C. Q. M.

Washington, D. C.—Sealed bids are asked until Jan. 7 for constructing a water tank and tower at the Mt. Pleasant School, Mich. W. A. Jones, comr. Indian Affairs.

Dayton, O.—Sealed bids are asked until Jan. 20 for furnishing and delivering 800 ⅝-in., 20 ¾-in., 15 1-in., 5 1½-in. and 5 2-in. water meters. Louis Haas, prest. B. P. L.

Milwaukee, Wis.—Sealed bids are asked until Feb. 1 for furnishing a pumping engine, boilers and auxiliary machinery for the Kinnickinnic river flushing tunnel. Chas. J. Poetsch, chmn. comrs. pub. wks.

Prophetstown, Ill.—Bids will be received Jan. 19 for a steel tower and tank, two miles of mains, pumping station, gasoline engine, and triplex pump. Iowa Engineering Company, engrs., Clinton, Ia.

Minneapolis, Minn.—Bids are asked until Jan. 8 for furnishing 815 tons of 6, 8, 12 and 16-in. c. i. pipe; 64 6-in.; 3 8-in. and 4 12-in. valves; 103 hydrants; 25 tons special casting. L. A. Lyrard, cy. clk.; Andrew Rinker, cy. engr.

St. Paul, Minn.—Bids are asked until Jan. 11 for furnishing 4 to 16-in. water gates; 10,000 ft. 6-in., 4,000 ft. 12-in., 7,200 ft. 16-in. water pipe with privilege of additional pipe hydrants; 1,000 stop boxes; 4 to 16-in. valve boxes; cast iron specials. John Caulfield, secy. water comrs.

Washington, D. C.—Sealed bids are asked until Jan. 7 for constructing 18 mls. of canal, pressure pipes and tunnels, together with headworks, spillways and gates for the diversion and conduction of about 200 cu. ft. of water per second from Salt river, about 25 mls. north of Globe, Ariz., for power purposes. E. A. Hitchcock, secy. int.

CONTRACTS AWARDED.

Chickasha, Ind. Ter.—The contract for building the waterworks system was awarded to Burns & McDonnel of Kansas City.

Seattle, Wash.—The Pacific Coast Pipe Company was awarded the contract Dec. 5 for 8-in. banded wooden pipe with iron couplings for $66,792.

Regina, N. W. T.—The contract for a new waterworks system was awarded to Dobson, Jackson & Fry.

Clinton, Mass.—The contract for constructing the south dike of the Wachusett reservoir was awarded to Nawn & Brock of Boston for $128,015.

Riverside, Cal.—The contract for constructing water mains in 14th-st., 47th-ave., 13th-st. and 13th-place was awarded to James J. Lynch for $2,628.40.

Newark, N. J.—The Board of Works adopted the water contract Dec. 17 presented by the Borough Council of East Newark for a term of five years at $60 per 1,000,000 gallons.

Salt Lake City, Utah.—The contract for water mains extension was awarded Dec. 12 to James Kennedy & Company of Fargo, N. D., for $24,486.

National Park, N. J.—The contract for constructing a water works plant was awarded, Dec. 2, to H. A. Miller of Wilmington, Del., for $4,134.60.

Aurora, Neb.—The contract for a new boiler and pumping machinery for the water works was awarded to Joseph Burns of Lincoln, Neb., for $5,288.

Helena, Mont.—The contract for building a municipal water works system was awarded, Dec. 14, to the Congress Construction Company of Chicago for $579,000. The bids were opened Nov. 25.

Blasdell, N. Y.—Special)—The contract for 492 tons of 4 and 6-in. c. i. pipe and 7½ tons of special castings was awarded to Wm. V. Briggs of New York City for $13,851; valves, hydrants and gate boxes, Eddy Valve Company, $2,300.

Marshalltown, Ia.—Contracts for the improvement of the water supply were awarded, Dec. 4, as follows: Constructing reservoir and pumping well and laying connecting pipe, Elzy & Dunn of Marshalltown, $17,200; c. i. pipe, U. S. Cast Iron Pipe & Foundry Company, Chicago, $26.25 per ton; valves, Rensselaer Mfg. Company, Troy, N. Y.

BRIDGES.

Morrisville, N. J.—A new bridge over the canal at Bridge-st. is proposed.

Carlisle, Ind.—The construction of an iron bridge in the city is contemplated by the co. comrs.

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Utica, N. Y.—The estimated cost of rebuilding Schuyler-st. bridge over Mohawk river is $7,000.

Midland, Mich.—Bids are asked until Jan. 4 for repairing upper bridge. H. D. Holden, clk. B. P. W.

Walpole, N. H.—A bridge over Connecticut river at North Walpole is contemplated by the selectmen.

Manitowoc, Wis.—Plans for a new foot bridge across the Manitowoc river have been submitted to council.

Rensselaer, N. Y.—The question of a bridge over Hudson river north of Livingston-ave. is being agitated.

Creston, La.—Bids are asked until Jan. 4 for all bridges to be built during 1904. Geo. Brotherton, co. audt.

Grand Rapids, Mich.—Bids will be asked in January for the Wealthy-ave. bridge. L. W. Anderson, cy. engr.

Stockport, N. Y.—This town voted Dec. 15 to appropriate $3,500 for building a foot bridge over Kinderhook creek.

Little Falls, N. Y.—The construction of a bridge across the creek in E. Mill-st. is contemplated. Cy. Engr. Lansing.

Portland, Ore.—Plans have been completed for a steel bridge across Balch Gulch at Thurman-st. Cy. Engr. Elliott.

Hastings, Neb.—Sealed bids are asked until 9 a. m. Jan. 4 for building bridges in Adams County. W. H. Davis, co. clk.

Wayne, Neb.—Bids are asked until Jan. 12 for building and repairing county bridges during 1904. Bert Brown, co. clk.

Chicago, Ill.—A bridge over the south fork of the south branch of the Chicago river at Thirty-first-st. is proposed during 1904.

Redding, Cal.—Bids will be asked at once for building a brick bridge across Calaboose creek at Yuba-st. Cy. Engr. Burson.

Dallas, Tex.—The City Council contemplates establishing a system of permanent bridges to be built of masonry and steel.

Centerville, Md.—Bids are asked until Jan. 12 for building a steel drawbridge over Kent Island Narrows. Joseph M. Parvis, clk.

Central Falls, R. I.—This city has appropriated $22,500 as its share of the bridge to be erected at Cross-st. jointly with Pawtucket.

Saginaw, Mich.—This city will apply to the county board of supervisors Jan. 11 for authority to construct a highway bridge across Saginaw river.

Bridgeport, Conn.—The joint construction of a concrete bridge over Ash creek is contemplated by this city and Fairfield. H. G. Schofield, cy. engr.

Colville, Wash.—Bids are asked until Jan. 4 for building a Howe truss bridge over Kettle River at station of Barstow, 8 mls. north of Marcus. Co. comrs.

Davenport, Wash.—Bids are asked until Jan. 4 for building a combination wagon bridge over Spokane river, near the town of Reardon. A. S. Brown, co. audt.

Hempstead, L. I.—The town board passed a resolution Dec. 14 to build an iron bridge over a creek on the Mill road, south of the village of Freeport.

Olivia, Minn.—Sealed bids are asked until Jan. 5 for building a steel bridge across the Minnesota River, near the village of Franklin. H. J. Lee, co. audt.

Streator, Ill.—The council has adopted plans for the proposed Marie-st. bridge. The plans provide for a steel bridge on concrete abutments and piers.

San. Jose, Cal.—Sealed bids are asked until 10 a. m. Jan 5 for a concrete bridge over Calabasas Creek on the Stevens Creek road. Henry A. Pfister, co. clk.

Rushville, Ind.—The contract for building a joint arch bridge between Fayette and Rush Counties was awarded to the National Bridge Company of Indianapolis for $1,040.

Eudora, Kas.—Bids are asked until Jan. 5 for a bridge over Kansas river at this place. Geo. A. Flory, clk. joint bd. comrs. Douglas and Leavenworth Cos. at Lawrence.

Boston, Mass.—Sealed bids are asked until 12 m. Jan. 16 for building the steel superstructure for Cambridge bridge. Patrick A. Collins, chmn. Cambridge Bridge Comn., City Hall, Boston.

Chicago, Ill.—Sealed bids are asked until Jan. 27 for constructing the substructure and superstructure of a bride across the Chicago river. Thos. A. Smyth, prest. bd. trustees sanitary dist.

Stroudsburg, Pa.—Bids are asked until Jan. 14 for rebuilding substructure and superstructure of a bridge over Broadheads creek. John E. Scott, secy. com. on bldgs. and grounds, Harrisburg.

Charlotte, N. Y.—The committee appointed to investigate the matter of building a bridge across Genesee river has reported to the board of supvrs. recommending the Bridge Road site. The county engineer has been directed to prepare plans.

Toledo, O.—Bids are asked until Jan. 20 for building abutments and approaches to the bridge in Keener road, Wonclora twp., and at Strickney-ave., Washington twp.; building a 40-ft. bridge over Cedar creek, in Jerusalem twp.; bridge and abutments on Lecor-ave., Washington twp. David T. David, jr., co. audt.

Los Angeles, Cal.—Bids are asked until Jan. 5 for constructing the Fourth-st. bridge, consisting of 8 spans, combination wood and steel, supported by steel towers and concrete-steel cylinders; Macy-st. bridge, combination wood and steel supported by concrete steel cylinders and concrete abutments. H. F. Stafford, cy. engr.

Dayton, O.—(Special)—F. M. Turner, cy. engr., says bids were submitted Dec. 22 for constructing a concrete steel arch bridge across the Great Miami river at Third-st. as follows: Charles Hoglen, Dayton, $179,600; Moore-Mansfield Constr. Company, Indianapolis, two bids, $192,870 and $196,070; J. O. Shoup, Dayton, $202,000; W. T. Gawne Company, Cleveland, $204,797; Adams Bros., Zanesville, $212,000; The Ferro Concrete Constr. Company,

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Cincinnati, $213,500; R. L. Fosburgh & Sons, Boston, $214,000; King Bridge Company, Cleveland, $219,500. T. A. Gillespie Company, Pittsburg, $220,000; G. H. Fath & Son Constr. Company, Cleveland, $247,861; H. E. Talbott & Co., Dayton, $248,640; M. Rabbitt & Sons Company, Toledo, $340,000.

PARKS.

Syracuse, N. Y.—The purchase of Kirk Park for public park purposes is proproposed.

Bangor, Me. — A proposition is being considered by this city providing for making Maplewood Park public.

Atlantic City, N. J.—An ordinance has passed second reading providing for the purchase of several squares of property in the Gardner tract for a public park.

STREET LIGHTING.

Glastonbury, Conn. — A new electric power plant is proposed.

Waverly, Minn.—The question of issuing bonds for an electric light plant will be voted on.

Dallas, Tex.—The question of a municipal light and power plant for this city is being agitated.

Beloit, Wis.—Plans have been prepared for a new municipal electric light plant. Robert, Caldwell, cy. engr.

Mechanicsburg, O.—The Mechanicsburg Light and Power Company contemplates the construction of an electric light plant.

Girard, Kas.—Plans and specifications have been adopted for an electric light plant. J. B. Grantham, cy. clk.

Buffalo, N. Y.—The trustees of the city and county hall have asked the county supervisors to install an electric light plant.

Kewanee, Ill.—The city council abandoned Dec. 23 the proposed plan of building and operating a municipal electric lighting plant.

Irvington, N. J.—The fire and water com. was directed Dec. 22 to solicit estimates on the probable cost of a municipal lighting plant.

Hancock, Mich.—A three-year contract has been awarded the Houghton County Electric Light Company to furnish street lights at $68 per lamp per year.

St. Paul, Minn.—The contract for street lighting during 1904 was awarded to the Cleveland Vapor Light Company, Cleve-

Joplin, Mo.; Rosalia, Wash.; Downey, Cal.

Yankton, S. D.—John J. Flatcher, who was engaged to examine the electric light plant which the city contemplates purchasing, reports that the value of the plant is $14,755.

Jeffersonville, Ind.—The suit of the United Gas and Electric Company against this city, involving the lighting contract, will be settled by compromise, according to press reports.

Addington, Pa.—The citizens of this town, Kershaw's Bank, Garrettford and Fernwood, and the towns in Upper Darby twp, are considering the question of street lighting for the entire township.

Bay City, Mich.—A resolution was adopted Dec. 21, directing city attorney Orr to prepare an ordinance empowering this city to engage in commercial lighting and furnish heat and power supply from electrical sources.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Calgary, Alberta—(Special)—This city desires to correspond with makers or builders of garbage crematories. F. W. Thorold, cy. engr.

St. Louis, Mo.—David R. Francis, prest. Louisiana Purchase Exposition, has authorized the erection of a garbage and light plant on the World's Fair grounds.

Charleston, W. Va.—The contract for erecting a crematory was awarded Dec. 17 to the Public Utilities Company, 15 William-st., New York City for $8,077 for a twenty-ton incinerator.

Harrisburg, Pa.—The sanitary committee approved Dec. 14, specifications for garbage collection, and bids will be received Jan. 7 for collecting garbage for periods of one to ten years.

Philadelphia, Pa.—Mayor Weaver is reported as considering a proposition made by John Pessano & Co. who offer to erect a garbage crematory for $1,500,000 if a thirty-year contract is given them.

New York City—Bids for the removal of snow and ice in Boro of Bronx were received Dec. 22 as follows: Rawling & Farley, 19 cents a cubic yard; William Bradley, 16 cents.; Thomas Crummins, 20 cents; Holland Bros., 21 cents.

Jersey City, N. J.—The contract for street cleaning and garbage removal for the fiscal year beginning Dec. 1 was awarded to Henry Byrne as follows: Sweeping about 2,950 stone-paved streets,

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MUNICIPAL ENGINEERING

VOLUME XXVI FEBRUARY, NINETEEN HUNDRED FOUR NUMBER TWO

THE SIEGES-ALLÉE: THE GERMAN AVENUE OF ART AND HISTORY.

By Frederick Stymetz Lamb, President of the Architectural League of America, New York City.

"How much good sculpture is wasted in New York," is a remark which has been recently made. New York possesses some of the finest sculpture, yet from the poor provision made for it the public at large is hardly aware of its existence. The subjects have been selected at random and the statues are located without reference to any general plan in the city's development.

The criticism made of New York is equally true of other cities. Good works have been created, but the results when completed have little or no effect owing to their haphazard location. It is true that within the last decade a serious effort has been made in the Public Library at Boston, in the Congressional Library at Washington, in the Appellate Court of New York to carry out a logical scheme of subjects suitably executed, either in painting or sculpture, but these few buildings are insufficient to redeem our work as a whole from the criticism of being spasmodic and haphazard. Even when plans have been started, such as the series of statues in the Mall at Central Park, or the portrait statues of National Heroes at Washington, they have not been adhered to with any degree of consistency. The scale of the figures is often changed and minor details so modified as to defeat the original purpose.

No field offers a better opportunity for individual effort. Great groups of buildings have been projected, like the Leland Stanford University and the University of California, and even in part completed, but up to the present time no effort has been made in either painting or sculpture adequate to the growth and progress of the country.

It is interesting to compare what we have achieved with work in foreign countries. It is needless to say that the great cathedrals of Europe teem with statues and sculptured panels, and that even the minor churches are so enriched as to compel admiration. The smallest details of the architecture are so carefully studied and so deftly executed as to leave nothing to be desired. Legend after legend, story after story, is recorded with a truth and inspiration that have been the wonder of the present age. The state buildings, the city halls, the court houses, even the museums, have their historical records in permanent form where both sculptor and painter can find inspiration. The portrait statue is the same the world over, historical groups hardly differ enough to call for comparison, but one example exists which in the ability of its execution and the grandeur of the effect obtained shows what can be accomplished by individual effort.

The German Emperor on the Sieges Allee has placed before his people not only a record of the great rulers of his country, but a work of art which must command the attention of his people and for all time act as an inspiration to their patriotism. From the Koenigs Platz to the Kaemper Platz, he has placed on either side of the avenue a series of statues which not only portray the principal rulers of the country, but recall the important epochs of its history. The Emperor in presenting this gift said: "One quarter of a century has nearly passed since the union of the different German provinces to resist foreign aggression and to build up the new German empire. My capital city, Berlin, has so nobly performed her part that I want to give her something as a mark of esteem and respect. This gift is to represent the building up of the empire from the beginning to the present time, and especially to record the work of the Province of Brandenburg. My suggestion is to have an avenue lined with statues of the Margraves, Kings and Empe-

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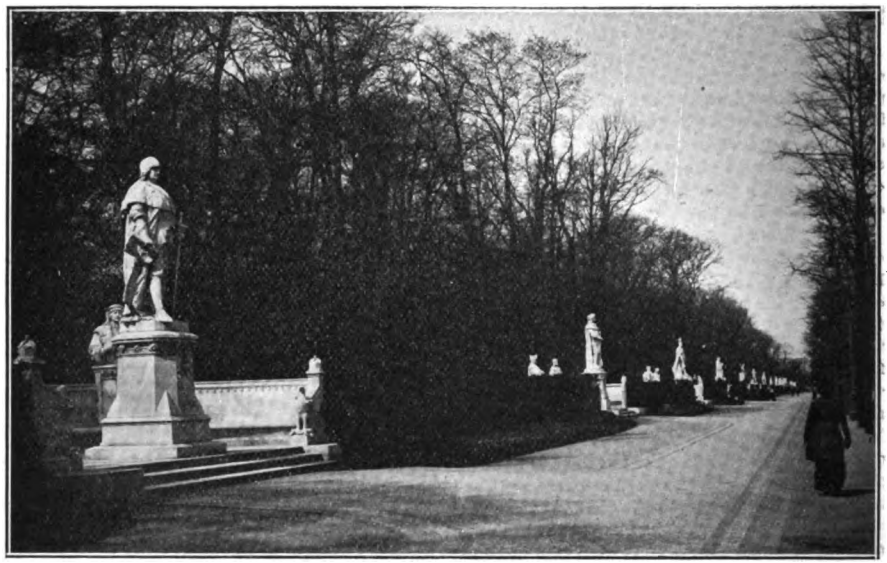
rors, who from the time of Albrecht the Bear to the Emperor William the First have contributed to the honor and glory of their country, as well as the portraits of the soldiers, statesmen and citizens who have aided in obtaining this result." The expense of this noble work was defrayed by the Emperor from his private purse, and it stands as a most notable example of the judicious expenditure of private funds for the public benefit.

Beginning with Margrave Albrecht the Bear and ending with King William the First, this series includes thirty-two of the important rulers who have contributed to the success and prosperity of their country. Each statue is placed on a dignified pedestal in the center of a semi-circular seat, in the detail of which it is endeavored to carry out the spirit of the time. Portraits of two important men of each reign, usually the leading warrior and the most important statesman, complete the composition, and also each age and its environment. Each of the statues is happily placed against a background of green foliage. They are located directly opposite each other and at equally distant points, making the effect of the avenue, as a whole, one of exquisite beauty. The Emperor has not only enriched the Thiergarten of Berlin, but has placed there a work of art which is representative of the age and which will be famous for years to come.

The same scale has been retained throughout, and the details, while modified to give individual character, are so placed as to retain the decorative effect desired. While no less than thirty different sculptors have been employed, the work has a unity which is surprising, and shows the controlling force of the mind which projected the scheme.



THE SIEGES-ALLÉE, BERLIN, GERMANY.

We are repeatedly told in these modern days that great works are not possible because of the short time allowed for their execution, and that the greatest

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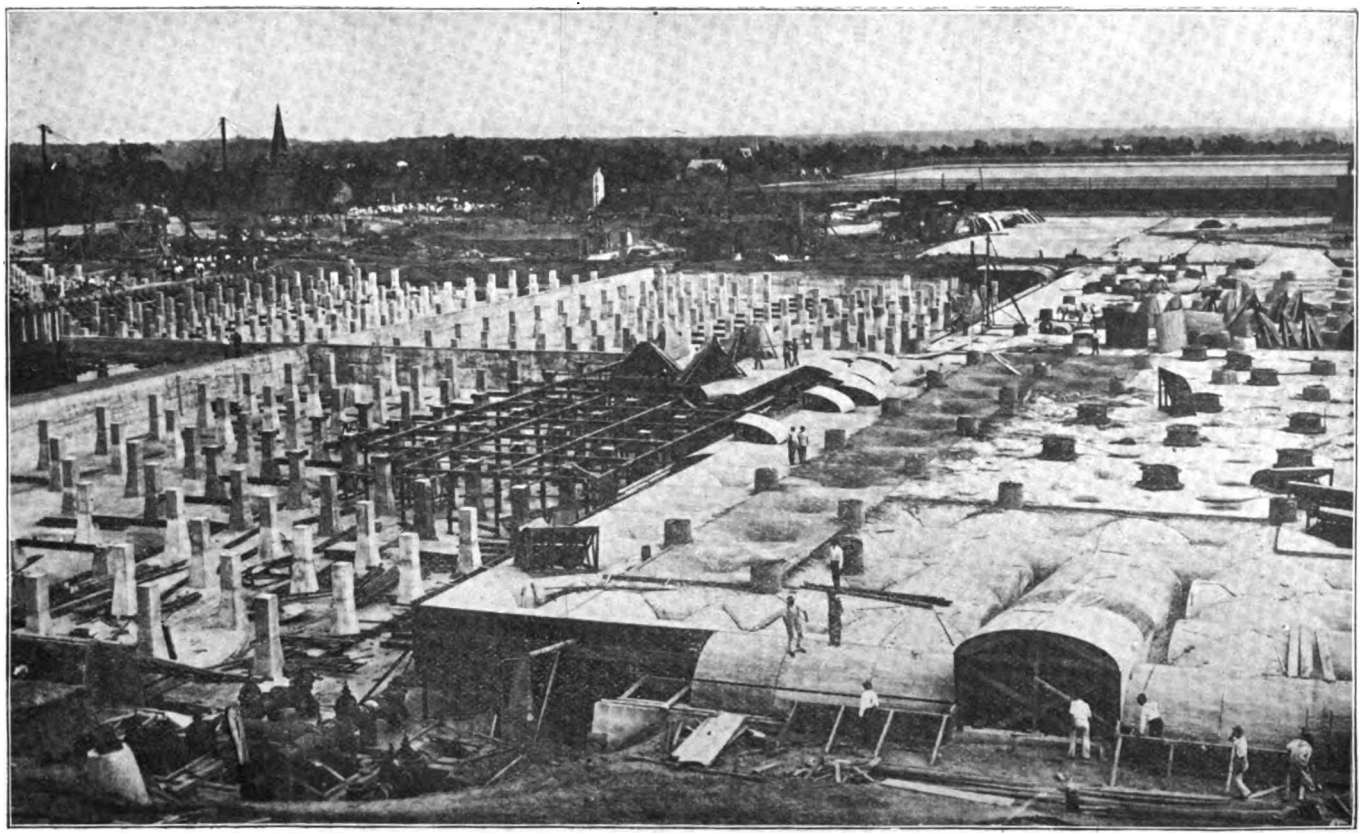

I. PHILADELPHIA FILTRATION PLANTS.
Upper Roxborough Filter Beds Under Construction.

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improved, but the effect of the completed work as it stands today has never been surpassed; for it combines not only the dignity of composition and the charm of artistic treatment, but appeals to the patriotism of all who behold it.

Here the history of Germany may be traced from the first Margraves of Brandenburg to King Karl the Fourth, the first of the kings, and on through that long series of rulers to the Emperor William the Great. The personality of the conquerors seems to speak in the statués; the charming picture of Johann First and Otto Third, twin brothers, ruling for thirty years in perfect amity, is placed before us, and one cannot walk through this beautiful avenue without feeling refreshed, uplifted and inspired with renewed respect for the past of the country and its present ideals.

Why should Germany be the only country to thus fittingly immortalize her rulers? Are there not in this land donors sufficiently generous to be fired with emulation at the example set by the Emperor, or is there not sufficient public spirit to induce the government to place a similar record for the benefit of the people?

The accompanying photograph shows one side of the avenue and makes clear both the general design and the common plan for the details of each group. The semi-circular niches set in a background of foliage, the principal statue in each group representing the ruler, the portrait busts of warriors and statesmen and the general style of their setting and ornamentation will be readily recognized, and an idea of the artistic effect as a whole and in detail is clearly formed.

SOME DETAILS OF THE PHILADELPHIA WATER FILTRATION PLANTS.

Several descriptions of the plans for water filtration in Philadelphia and of the methods of construction have appeared in Municipal Engineering. We present this month some views of details of construction and operation which will be of interest, the photographs being furnished by the Bonneville Portland Cement Company, whose Star brand of Portland cement has been largely used in the work.

Plate I gives a view of the unfinished filter beds at Upper Roxborough, taken from a point about 75 feet above the ground. The dimensions of the separate beds and their grouping are readily seen. Those on the left are in the earlier stages of construction. Those further to the right have the roof pillars in, one of them showing the placing of the centering for the construction of the roof. Those at the extreme right are receiving the concrete roof, part of which is completed.

The floors, piers, walls and roofs are made of Portland cement concrete in the proportions of one part cement, three parts of sand and five parts of broken stone. The pillars are monoliths, the walls are built in monolithic sections with covering the sections between the rows of pillars shown in the beds in plate I. The openings in the roof for some of these ventilators will be seen in plate V.

Some of the details of the sand washing apparatus are shown in plates III, IV and V. A view of the ejector for removing dirty sand from the filter and a description of its operation will be found in Municipal Engineering, vol. xxv, pp. 153 and 154. Plate III shows the opening in the roof of a filter at Lower Roxborough for the sand incline, through which the sand is passed. Plate IV shows the sand incline in Belmont filter No. 9, from below, supported on steel beams imbedded in the roof pillars. On the floor will be seen the main collector for filtered water, the filtering material not being in place when this photograph was taken. Plate V gives a side view of the sand incline in Belmont filter No. 8, near its lower end. It also shows clearly the vaulting in the roof, the method of supporting the roof on the pillars and the location of the ventilators.

Plate VI shows a rear view of the massive concrete gate chamber of the reservoir at the Belmont filter plant under

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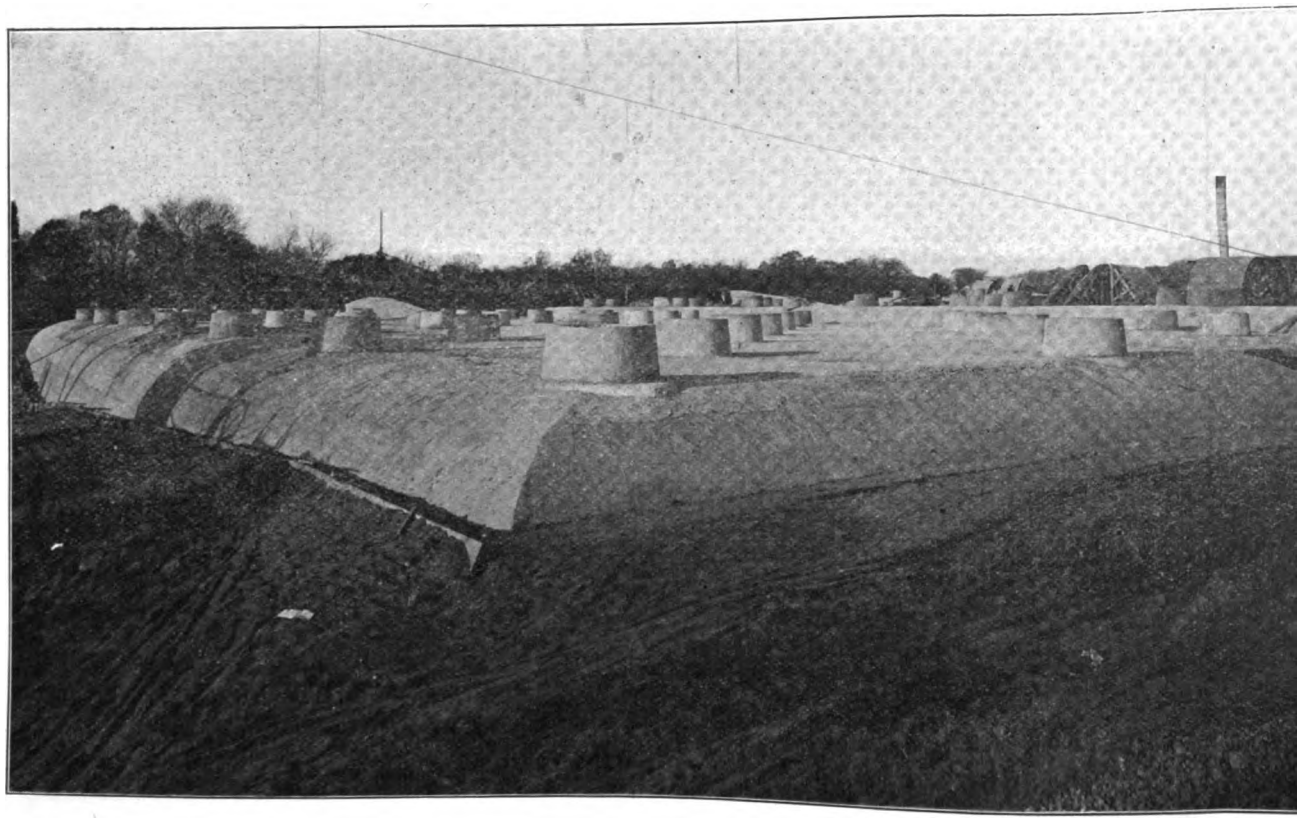

II. PHILADELPHIA FILTRATION PLANTS.
Top of Lower Roxborough Filter Beds, Showing Roof and Ventilators.

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series of tests of compressive strength of concrete cubes ever undertaken is included. The publication of the entire set of results is awaited with much interest. Some of them have already been published. The Bonneville Portland Cement Company publishes full notes of many tests upon its Star brand showing the results of the tests and the action of the test blocks in the machine.

THE BRICK OF THE FUTURE.

By F. H. Doremus, Kingston, N. Y.

In every large building center between our coast lines the attention of architects and buildings has lately been focused on an important structural material, comparatively new to the states, and called variously "sand brick," "mortar brick," or "sand-lime brick." To those out of touch with the trend of architectural developments, and the production and sale of building supplies, the use of these new brick will seem to have sprung up in a night, but the truth is that they have had an evolution covering more than thirty years. In central Germany, where the sand-lime brick had their inception, stone and clay brick for building purposes are not plentiful, and necessity has been the spur that has driven the process of making bricks from lime and sand toward perfection. When the discovery was made that it was possible to harden the freshly pressed brick under steam pressure (they had previously been hardened by exposure to the air for a period of three or four months), the industry grew with great rapidity. The sand-lime brick are now manufactured extensively in England and France.

Oddly enough, these new brick, of a beautiful appearance, beside which the ordinary red brick look crude and common, have met with a reception in America less appreciative than the circumstances seem to warrant, and that, too, in a country proverbially eager to utilize every innovation that promises to be an improvement over old ways and means. The new brick people have chanted the praises of their several systems enthusiastically and insistently, but investors have assumed a waiting attitude difficult to explain. "We can make you a brick more durable than sandstone itself, because natural sandstone is liable to strata of inferior substances which yield readily to decay when exposed to the elements," declare the sponsors for the new brick. "We can make them of any desirable color, perfect in form, uniform in weight, smooth as polished stone, with strong, clean-cut corners, make them one day ready to be laid in the wall the next, make them in winter as well as in summer, and make them of materials so plentiful as to be found almost anywhere —merely sand and lime. We claim that our brick will not absorb more than a fourth as much water as the ordinary building brick, and will, therefore, make a dryer wall, that they will withstand a crushing strain exceeding that of any other pressed brick in any market, and that exposure to the elements increases their hardness. But what is better than all this, we claim that we can manufacture this high-grade face-brick at a cost that will compare favorably with the cost of making common red brick!"

Of course, all this sounds alluring--suspiciously so. If there are any obstacles to be set aside—and, doubtless, there will prove to be a few—the brick companies all claim to be unaware of the fact. It is hardly surprising that investors have been tempted to remind themselves that they have heard of "ropes of sand," and even "gold bricks," as well as some other things too good to be true, and especially designed for the undoing of the guileless, and naturally prefer to wait and see what others are going to do about the matter.

Though the intervening time since the introduction of sand-lime brick into this country has been a time of comparing, testing and observing, there is certainly no denying that these brick have rendered an exceedingly satisfactory account of themselves. A number of factories have been established in various parts of the country and these have served as valuable object lessons to the public at large, while the analyses of experts of ability and veracity have gone far toward reassuring those essentially interested. The writer himself has gone to some trouble to investigate the claims of two representative companies. The tests in both cases were excellent and beyond all cavil, especially the tests for tensile and compressive strength.

The period of rigid investigation over, there seems no legitimate reason why these new brick should not win the con-

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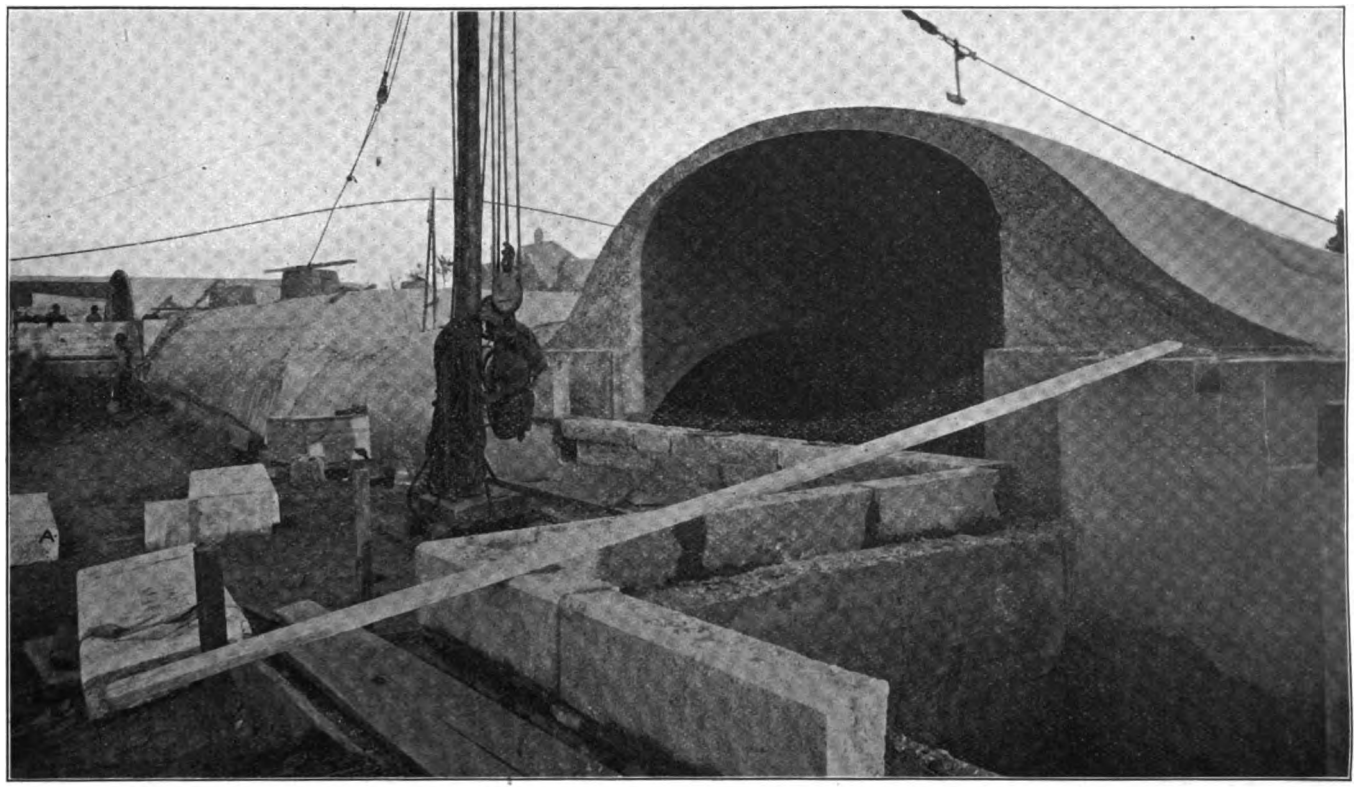

III. PHILADELPHIA FILTRATION PLANTS.
Regulating Chamber and Sand Incline Opening Into Lower Roxborough Filter Beds.

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fidence of the building world. The process of manufacture is so simple that one cannot but wonder why it has not come into vogue long ago, and the fact that the raw materials are so generally available should contribute to their popularity. The sand-lime bricks are really blocks of artificial sandstone in a convenient form for handling; but when one considers the time, labor and expense required to quarry and dress similar blocks of natural sandstone to a corresponding perfection the great utility of these new brick becomes at once apparent. The moderate cost of production will, at the same time, make them a formidable rival to clay brick.

We are told that this new artificial sandstone may be pressed into many shapes beside the usual parallelopiped form—in fact, into an infinite variety of shapes, mouldings, cornices, newels, corbels and pillars of every known order, from base to fillet, and that the natural adaptability of the material will lend itself most readily to architectural ornamentation. The colonial architecture of our ancestors was as distinctly characteristic of our national life as the Taj Mahal is an expression of Hindu artistic ideas. After a long and fearful wrestle with the ubiquitous "Queen Anne," our notions of home building have reverted to the simple and dignified architecture of our early days. The colonial era under way is one that is glorified by a quickened artistic perception and influenced by the best the Old World has had to teach. And, seemingly, in answer to the need of this new-old phase in our architectural history, these new gray brick have come, and seem to have been especially designed.

NEW JERSEY PUBLIC ROADS.

The state of New Jersey is proceeding with its road improvements at an increasing rate, the number of miles constructed in 1902 being nearly 50 per cent. more than in any preceding year. The state has now paid $1,265,000 in aiding the construction of 797 miles of road. The state helped pay for 155 miles of the 201 miles of road built in 1902. We are indebted to Henry I. Budd, Commissioner of Public Roads, for the opportunity to present the accompanying illustrations of the effects of some of the improvements which have been made.

The first pair of pictures shows one of the deep cuts on the Holmdel and Marlboro road in Monmouth County, during and after improvement. This road is but 3.43 miles long, but the grading is so heavy, on account of deep cuts and high fills, that it has required two years for construction. The grading and underdraining cost $7,848.06, or $2,288 a mile. It was macadamized 14 feet wide and 6 inches thick at a cost of $21,834.72, or $6,365 a mile. The total cost was $8,742 a mile. The maximum grade was reduced from 4.92 per cent. to 3.6 per cent.

The second pair of cuts shows the Stoy's Landing road in Camden County before and after improvement. This road is 1.42 for grading, and the extra foundation costing less than $150. The cost per mile, with macadam 12 feet wide and 8 inches deep, was $7,756 a mile.

The third pair of pictures shows the South Plainfield road, in Middlesex county, before and after improvement. This road is 1.34 miles long and the maximum grade was reduced from 3.5 to 2.25 per cent. The macadam is 12 feet wide and 8 inches thick. The soil is sandy loam. The cost of the road was $5,913.88, or $4,413 a mile, about 10 per cent. of which seems to be chargeable to grading. This is hardly half the cost of macadamizing the other roads mentioned in this article. The reason is that the contract for macadam was let at 48⅞ cents a square yard, as compared with 89 cents for the Stoy's Landing road of the same width and depth.

The fourth and fifth pairs of pictures show the River road in Camden county before and after improvement. This road is 3.21 miles long and has also been difficult to grade because it crosses many deep ravines. The soil is sand and clay-gravel. The macadam is 15 feet wide and 10 inches thick. The maximum grade was reduced from 9.18 per cent. to 4.81 per cent. The total cost of the road was $34,156.15, or $10,640 a mile. Of this about $2,230

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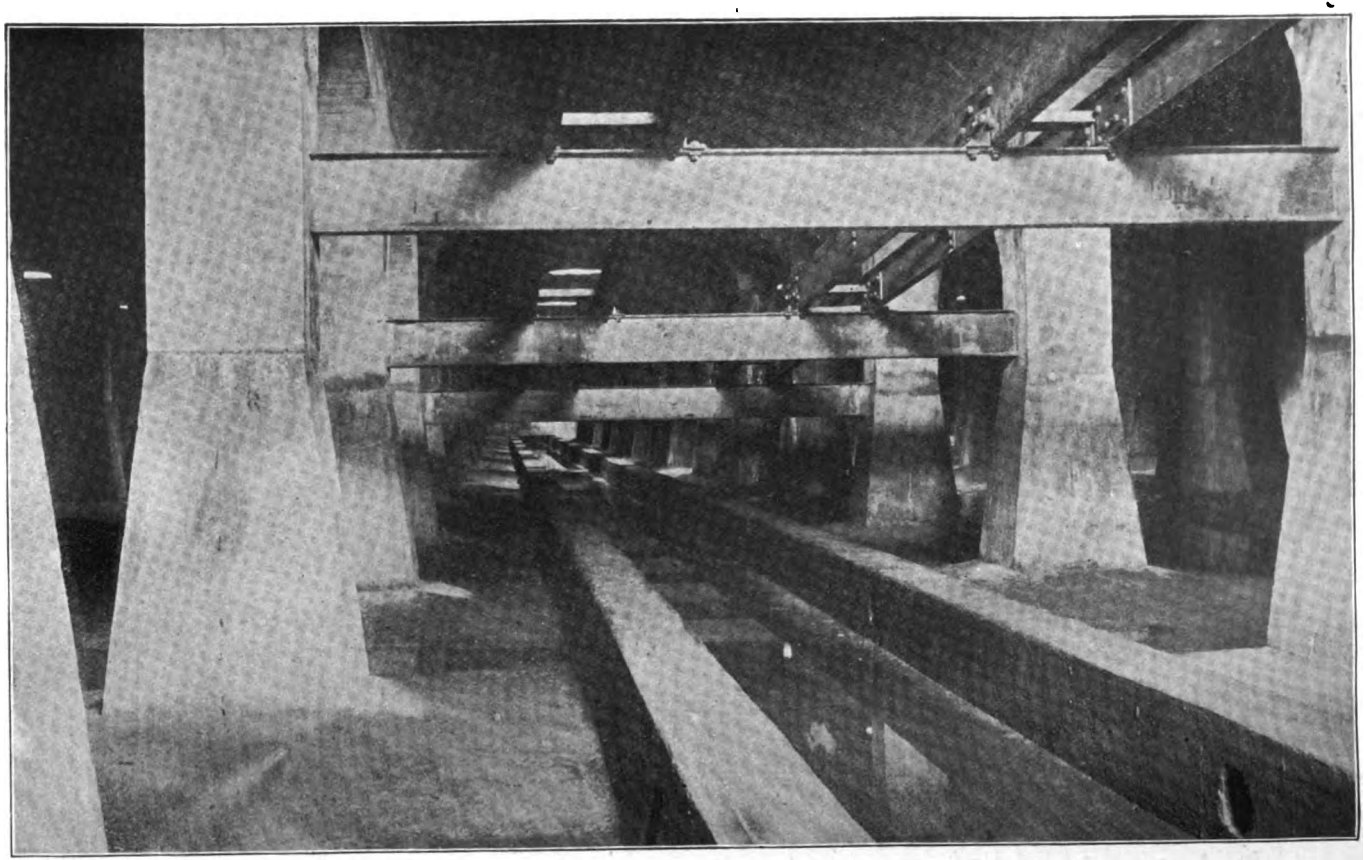

IV. PHILADELPHIA FILTRATION PLANTS.
Sand Incline and Main Water Collector in Belmont Filter Bed No. 9.

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EDITORIAL COMMENT

The Outlook for the Cement Trade.
State Aid of Road Improvement.
Charges for Professional Services.
The Duty of the State in Protecting Water Supplies.

THE OUTLOOK FOR THE CEMENT TRADE.

The collection of data regarding the cement trade in 1903 for the third edition of the "Directory of American Cement Industries," now in the hands of the printer, is not completed in time for a full study of the conditions of last year and the prospects for this year in this February number of Municipal Engineering, but some general statements may be made which are preliminary to the fuller data to be presented in the "Directory" and summarized in later numbers of this magazine.

The report of the United States Geological Survey on the production of cement in 1902 was issued early in January, 1904, and it will be interesting to compare its data with the estimates made in an article in Municipal Engineering in February, 1903, on "The Cement Industry and Its Prospects for 1903" as a basis for further predictions.

The article referred to estimated that 60 Portland cement works were in operation in 1902, producing 14,400,000 barrels. The official returns show 65 works in operation at the date of making reports, and that the total production was 17,230,644. This figure is about 400,000 barrels greater than the department's preliminary estimate issued in June, 1903. It is evident that this magazine's estimate of the production was conservative, as stated when it was made.

The increase in production in 1902 over 1901 was 4,519,419 barrels, or 35.6 per cent., while the increases for each of the six preceding years were 50 per cent. or more, except 1898, which was 38 per cent.; but 1897 offset this by a percentage of increase in the last six months of 1902 and continued during the first six months of 1903.

Some details of the Geological Survey's report will be found elsewhere in this number of Municipal Engineering.

The article referred to estimated that there would be 72 Portland cement factories in operation in 1903, producing 19,440,000 barrels. The accuracy of this estimate will be tested shortly when the present compilation of data for the "Directory of American Cement Industries" is completed and published in that book. The labor troubles of the year in the East and the consequent cessation of building operations reduced the demand for cement and consequently the production of the eastern mills for the latter part of the year. The effect was not so marked upon the western mills, some of which were running full time upon the low prices set by the overstocked eastern mills. It is probable, therefore, that the effect upon the total production of the country was not so serious as it appeared to be upon a study of the drop in prices, and that the estimate of 19,440,000 total production in 1903 is a conservative one.

As to the prospect for 1904 it may now be said that it is favorable with one or two rather prominent "ifs." The legitimate demand for cement is increasing quite as rapidly as the supply and with normal financial and labor conditions will tax the productive capacity of the mills now in operation and construction, and possibly demand some importation. This means good prices for the product and good profits for the mills which do not need to ship long distances by rail. The action of the large manufacturers in closing their mills "for much needed repairs" will prevent the accumulation of

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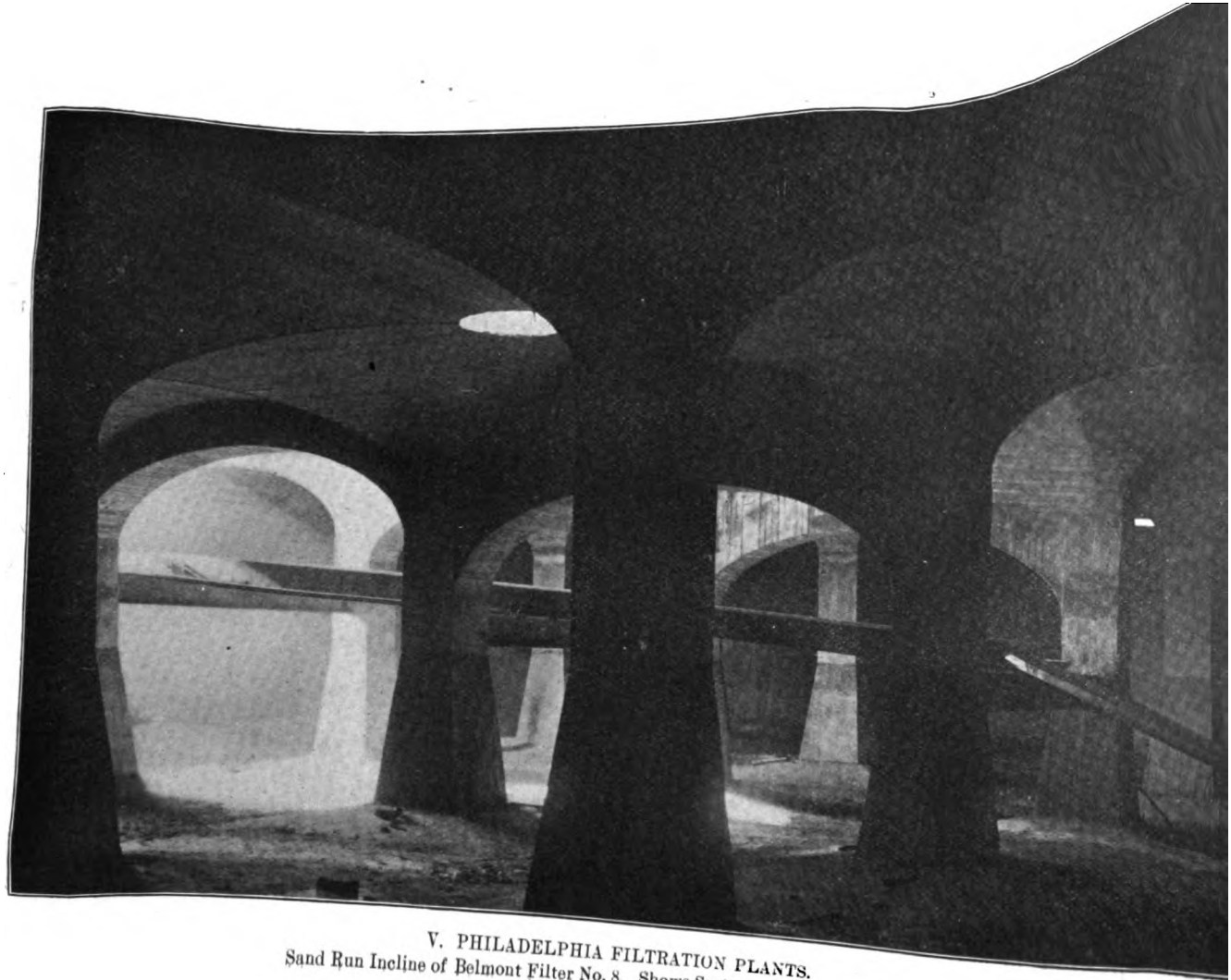

V. PHILADELPHIA FILTRATION PLANTS.
Sand Run Incline of Belmont Filter No. 8. Shows System of Pillars and Vaulting.

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increased each year. If this happens the supply will be nearer the demand. Last year the labor troubles were localized, and while the largest markets were seriously affected, they were but few in number and the general demand for cement was good. What they will be this year cannot be predicted.

At this time there is some financial stringency, but it seems to be the general opinion that this is due to over-capitalization and to the results of speculation in such diluted stocks, and if this be true it will be temporary and may pass over in time to permit the fullest expansion of legitimate enterprises involving construction next year. This can be more safely estimated than can the effects of labor agitations.

The large eastern manufacturers are certainly on the safe side in restricting production if the smaller field of view is covered and the safety of individual corporations is the only consideration. If, however, as seems very probable, the conditions will approach the normal this year, the restriction will have an unfortunate effect upon the stability and continuity of progress in the cement trade, which was considered in this department on page 17 of the January number

STATE AID OF ROAD IMPROVEMENT.

The State Engineer and Surveyor of the State of New York has issued a bulletin showing the progress in the improvement of the roads of that state since the state aid law has been in operation. The showing is very satisfactory so far as it goes, and is under discussion at the annual Supervisors' Highway Convention at Albany as this magazine goes to press. It can be and doubtless will be used effectively in the campaign before the Legislature to secure funds for more work in the future.

The law provides for the payment by the state of half the cost of roads petitioned for which the counties have adopted and for which they have appropriated the other half of the cost. The difference between the appropriations by the counties and by the state is very counties and appropriated for would have been increased if there had been any prospect of early construction of the roads. As the case now stands, the counties have appropriated $5,540,587 and the state but $2,065,000 in the six years since the law went into effect. This leaves the state about $3,500,000 behind, and at the present rate of annual appropriations it would require about six years for the state to provide its share of the necessary funds.

A neat showing of these facts is made in the bulletin referred to, in the form of a statement showing the roads which have been petitioned for and appropriated for so far as the county's half is concerned, arranged in the order of filing and in the order in which they must be constructed under the state aid law. In the margin is shown at intervals the amount of appropriation which must be made to cover the roads in the list down to the point marked, thus showing what sums from $200,000 to $3,558,000 will accomplish and making it to the interest of each member of the Legislature to cover as many of the items of direct bearing on his constituents as possible.

There does not seem to be any record of the mileage of roads built in the state without state aid, but if the state cannot keep up its end it would seem necessary for some localities to construct their own roads. The fact that their neighbors have received state aid doubtless delays the undertaking of this work.

The state of New Jersey has a state aid law under which the state pays one-third the cost of the roads adopted by the Commissioner of Public Roads up to $250,000 a year. In 1902 155.365 miles of roads were constructed at a cost of $750,000, and in addition 45.964 miles were built which were not paid for by the state in that year. The cost of roads in New Jersey is less than that in New York. Figures for the former state, given in an article elsewhere in this number of Municipal Engineering, may be compared with some for the latter state in vol. xxiv, p. 409. Since 1893 New Jersey has constructed 796.8 miles of road at an expense to the state of $1,365,168, or a total cost of $3,795,504. Since 1898 New York has constructed 298 miles with state an-

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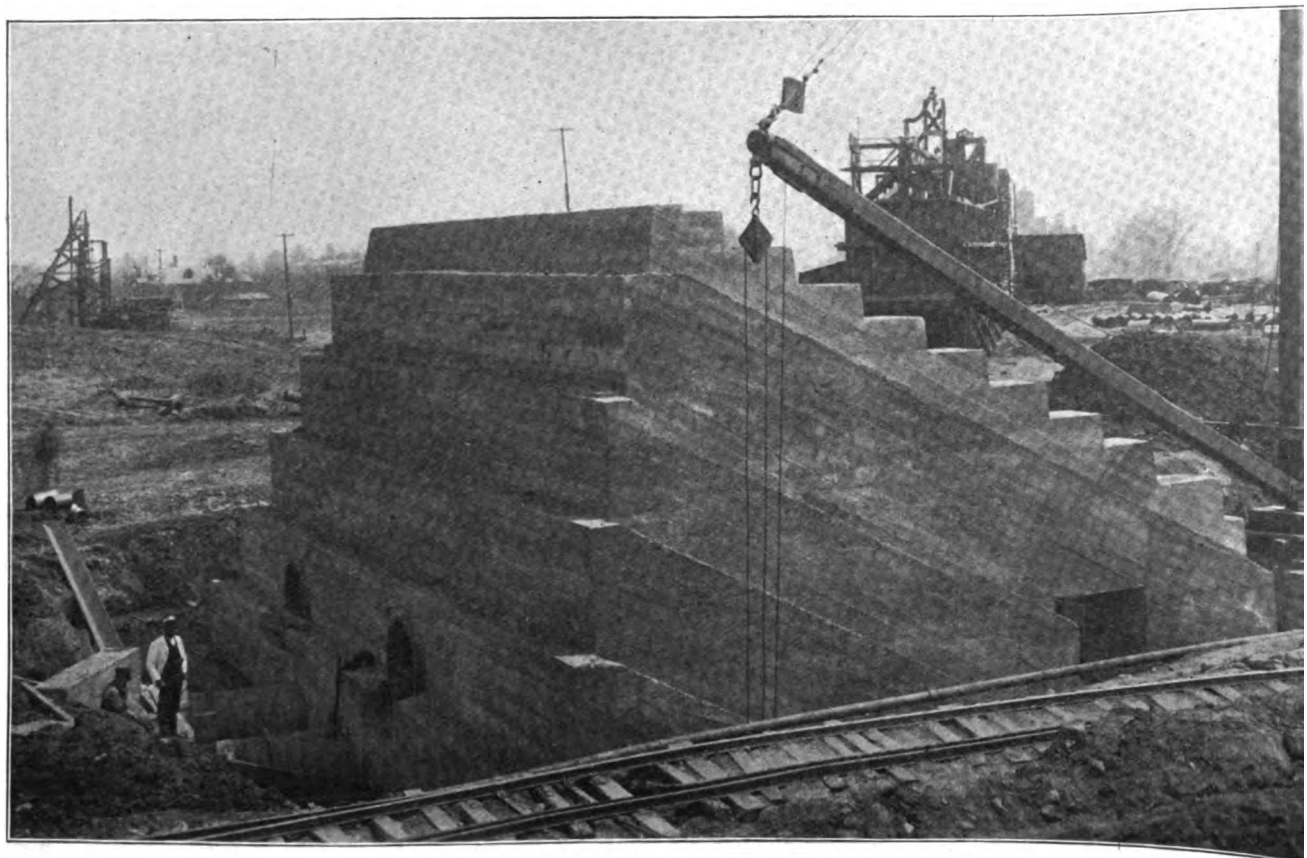

VI. PHILADELPHIA FILTRATION PLANT.
Reservoir Gate Chamber of Belmont Filter Plant.

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broken stone roads, which have cost about $24,000,000. They have been constructed under the county or district system, and the rate of construction has been far more rapid than in the states where state aid is in vogue. Indiana is greatly favored by wide distribution of reasonably good road materials, but much of the difference in cost is due to cheaper construction. Is it not good economy to build many of the cheaper roads at first rather than a few excellent roads? The development of the country with the improvement in roads makes it better able to pay for the better roads when the first construction wears out. There is a rivalry among districts to get the largest number of good roads rather than a rivalry to get the largest proportion of the state appropriation. It results in such feats as a hundred miles of new road put under construction in a single county in a year and in 500 or 600 miles of reasonably good roads in each of a number of counties.

For the newer states, especially if road material is abundant, the district system seems most satisfactory. New York and New Jersey may perhaps be considered to have passed that stage in road building and to be ready for the better roads which it is now securing. Indiana is rapidly coming to the same stage and will soon be ready for a state aid law.

Theoretically, the state should pay some proportion of the cost of main roads, though one-half or even one-third seems excessive, and it is difficult to draw the line between roads which should receive state aid and those not deserving it

There is considerable agitation in some quarters of the proposition of national aid in the building of good roads. This is an entirely different proposition. The reasons for state aid do not apply to the national aid proposition and no others have been presented which are any more satisfactory. Paternalism and socialism are neither of them elements of our form of government and all the arguments are based on one or the other or are the politicians' bid for votes.

CHARGES FOR PROFESSIONAL SERVICES.

The American Institute of Architects and gives rise to several questions, such as its effect uopn architects and their clients, the possible effect of a similar schedule upon the clients of various classes of engineers, the relative value and propriety of such schedules for architects and for engineers. Does the existence of such a schedule have any appreciable effect upon the professional fees of architects in general, especially those of architects who have not yet attained to high standing or the reputation with the public to which they are entitled by reason of their abilities? Would it have any effect upon the receipts for professional services of engineers of any grade?

Is it not true that the public in general has no adequate idea of the value of engineering services and consequently has a deep-seated aversion to paying what such services are worth? Would not such schedules as this, if adopted by the engineering profession generally through its societies, from the national organizations down to local associations, be well worth while, simply as a standard to which to point, and an educator of the public and private client, particularly of the municipal official? The fact that any schedule must be modified somewhat to suit special cases does not materially affect the answers to these questions. What probably prevents the discussion and possibly the adoption of such schedules is apparently the fact that the national societies, which must first present the matter if it is to meet with any large measure of success, are in the control of those whose business connections or professional standing are such that their dealings are with clients who more fully recognize the value of professional services and are often willing to pay more than the profession at large would feel justified in fixing as schedule charges. Perhaps they fear that a schedule of minimum charges would reduce the ideas of their clients regarding their own compensation. They evidently differ from members of all other professions in thinking schedules of charges somewhat beneath their professional dignity.

The circular of the American Institute of Architects is as follows:

The architect's professional services consist in making the necessary preliminary studies, working drawings, speci-

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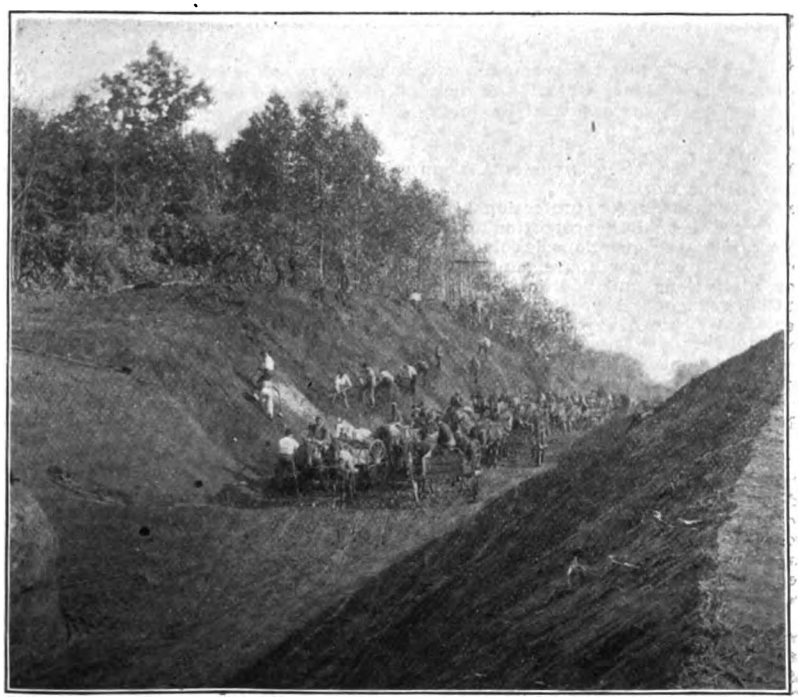

Before Improvement.

After Improvement.
NEW JERSEY PUBLIC ROADS.
Deep Cut on Holmdel and Marlboro Road in Monmouth County.

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$10,000, and for furniture, monuments, decorative and cabinet work, it is usual and proper to charge a special fee in excess of the above.

For alterations and additions to existing buildings, the fee is 10 per cent. upon the cost of the work.

Consultation fees for professional advice are to be paid in proportion to the importance of the questions involved.

None of the charges above enumerated covers alterations and additions to contracts, drawings and specifications, nor professional or legal services incidental to negotiations for site, disputed party walls, right of light, measurement of work, or failure of contractors. When such services become necessary, they shall be charged for according to the time and trouble involved.

Where heating, ventilating, mechanical, electrical and sanitary problems in a building are of such a nature as to require the assistance of a specialist, the owner is to pay for such assistance. Chemical and mechanical tests, when required, are to be paid for by the owner.

Necessary traveling expenses are to be paid by the owner.

Drawings and specifications, as instruments of service, are the property of the architect.

The architect's payments are due as his work progresses in the following order: Upon completion of the preliminary sketches, one-fifth of the entire fee; upon completion of working drawings and specifications, two-fifths; the remaining two-fifths being due from time to time in proportion to the amount of work done by the architect in his office and at the building.

Until an actual estimate is received, the charges are based upon the proposed cost of the work, and payments are received as installments of the entire fee, which is based upon the actual cost to the owner of the building or other work, when completed, including all fixtures necessary to render it fit for occupation. The architect is entitled to extra compensation for furniture or other articles purchased under his direction.

If any material or work used in the construction of the building be already upon the ground or come into the owner's possession without expense to him, its value is to be added to the sum actually expended upon the building before the architect's commission is computed.

In case of the abandonment or suspension of the work, the basis of settlement is as follows: Preliminary studies, a fee in accordance with the character and magnitude of the work: preliminary studies, working drawings and specifications, three-fifths of the fee for complete services.

The supervision of an architect (as distinguished from the continuous personal superintendence which may be secured by the employment of a clerk of the works) means such inspection by the architect, or his deputy, of work in studios and shops, or of a building or other work in process of erection, completion or alteration, as he finds necessary to ascertain whether it is being executed in conformity with his drawings and specifications or directions. He is to act in constructive emergencies, to order necessary changes and to define the true intent and meaning of the drawings and specifications, and he has authority to stop the progress of the work and order its removal when not in accordance with them.

On buildings where the constant services of a superintendent are required, a clerk of the works shall be employed by the architect at the owner's expense.

THE DUTY OF THE STATE IN PROTECTION OF WATER SUPPLIES.

The question of the purity of water supplies has been one of much prominence recently and the defects of existing laws and methods of treatment of the subject have been clearly shown by several occurrences. The state of Indiana has the most defective laws which have been tested in the courts, and it is only by good fortune that it has not been subject to such epidemics of typhoid fever as those which have occurred very recently at Ithaca, N. Y., and Butler, Pa. The secretary of the State Board of Health is doing all in his power to educate the sentiment of the public and to overcome the legal and financial difficulties in the way of a proper protection of the streams of the state, which is impossible without direct legislation, for the lower courts of the state have decided in more than one case that the streams of the state are naturally the recipients of sewage and that its discharge into the streams will not be prevented by them. It is also very difficult, if not impossible, to prove damages from such use of streams sufficient to justify the courts in giving judgments in favor of plaintiffs suing for their rights.

Each year the State Board of Health holds a school of health officers, in which lectures on their various duties are delivered by men of experience in them. At the last school Mr. Charles Carroll Brown, M. Am. Soc. C. E., gave a discussion of the subject of stream pollution by sewage in which he called attention to the fact that the streams of the state of Indiana are absolutely without protection. He mentioned the smaller water supplies, such as that of Bloomington, drawn from a watershed but a few hundred acres in area with a few scat-

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Before Improvement.

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tered houses, in which there was no attention paid to the sanitary condition of their drainage to the reservoir and no method of requiring such attention either with or without expense to the city owning the water supply. He also instanced such supplies as that at Seymour, on the east fork of White river, a larger stream with comparatively little pollution of a dangerous character, but likely to have large increase in the pollution from sewage by the construction and extension of sewerage systems in the cities on its watershed. The effect of the sewage of Indianapolis upon the west fork of the same river was also described. At low stages of the river the sewage is not sufficiently diluted and the deposits of sewage show to a serious extent for several miles down the river. The decomposition of the solids puts the stream in very bad condition, which becomes progressively worse until a rise in the water carries off the deposits. No fish life is possible. Before the Indiana Engineering Society, Dr. J. N. Hurty, the secretary of the State Board of Health, described an occurrence showing the effect of this poisonous matter upon fish. A report reached his office of the destruction of many thousand fish at Waverley, a few miles below the city. Upon investigation he found that the fish were either killed or were driven ashore by a slight rise in the river which floated out of the pools nearer the city the products of the sewage decomposition and the water which had lost its oxygen on this account. The fish were driven up the small streams and into bayous in search of air and were left there by the lowering of the water level, either killed by the poisonous water or left to die on the bare beds of the bayous. This river is used as a source of water supply many miles below.

The epidemic of typhoid fever at Ithaca was described by Mr. Brown, and the fact that it was due to a careless and accidental pollution of the immediate watershed of the reservoir of the city water supply, was brought out. The epidemic at Butler, Pa., then raging, was also attributed to similar pollution of the water supply. Dr. Soper's investigations and those of the Pennsylvania State Board of Health have shown this to be true, and also that the temporary failure of the filtration system aggravated the danger.

The state of New York has machinery which can be put in operation to protect any public water supply, but it does not seem to have been applied in the case of Ithaca before the epidemic. The state of Pennsylvania has some legal control over the purity of water supplies, though not so complete as that possible in New York. The state of Indiana has no control whatever by legislative enactment, and court decisions have taken away any possibility of control under any circumstances.

The occurrences at Ithaca and Butler show negligence which, in the former case at least, in the face of the possibilities of control, was almost criminal, and show that good laws are of no avail without intelligent supervision of their enforcement by the responsible local authorities. The authorities in the state of Indiana can now do nothing. They have no protective laws and their cases are thrown out of court.

The Indiana Engineering Society, at its recent convention, recognized these facts and passed resolutions calling attention to them and to the need of prompt action by the Legislature. It also recommended the filtration of all water supplies liable to accidental pollution of a dangerous character.

Possibly other states are in nearly as bad condition as Indiana. It is hardly possible that any state is quite so far down in the scale. If so, they should take lessons from the recent and more distant evidences of the serious effects of stream pollution and rectify their errors of omission and commision as promptly as possible.

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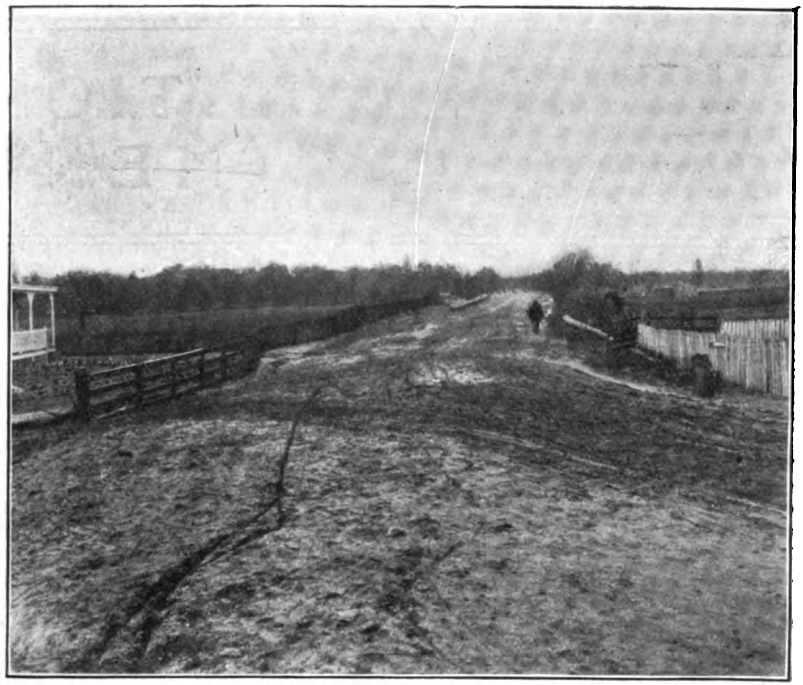
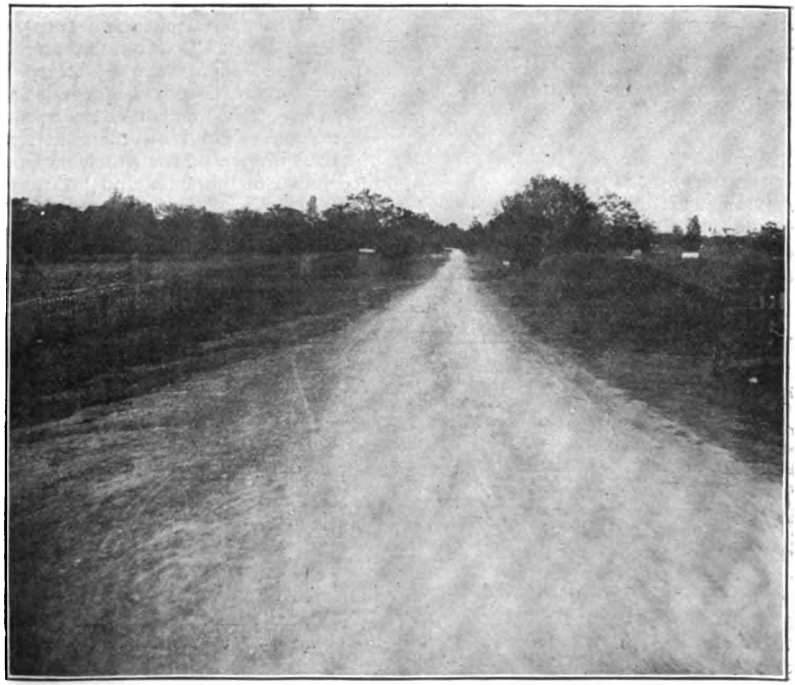


Before Improvement.



After Improvement.

NEW JERSEY PUBLIC ROADS.

River Road, Camden County.

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THE QUESTION DEPARTMENT

ROOTS OF TREES IN SEWERS.

I have been requested by the Board to write and ask if you know of some remedy that is a sure preventive of roots of trees, particularly elm trees, forcing their way into sewers.

JOHN A. WEDDELL,
City Clerk, Tarboro, N. C.

This question has been discussed in Municipal Engineering in the Question Department and elsewhere in vol. xviii, pp. 109, 171, 243; xxii, 155, 303; xxiv, 431, to which reference may be made for details. The conclusion seems to be that tight joints are the only salvation and that deep-socket pipe, say three inches, and gaskets and well rammed Portland cement joint filling are recommended for making them. Methods of removal of tree roots are also described.

BOOKS ON INVERTED SYPHONS.

Do you publish any works which treat of inverted syphons, or can you refer me to any book which treats of them?

F. E. MEYERS,
Canton, Ohio.

Folwell's "Sewerage" ($3) has the fullest treatment of this subject. See also Farnham's article on the Newton syphons in Municipal Engineering, Vol. xxv, p. 410 and two answers to questions in Vol. xxii, pp. 93 and 168.

THE CHICAGO TRENCH EXCAVATOR.

In the December, 1903, number of Popular Mechanics there is an article on the "Chicago Excavator," with photo. Can you tell me where this machine can be seen working? Will it work in sticky clay or quicksand? Where has any city work been done by it?

JAMES H. TURNER,
Zion City, Ill.

The machine referred to is one used by [illegible] clay, but, on account of the difficulty in sheeting the trench along the few feet between the lower end of the scraper and elevator and the surface of the ground, it would probably not operate in quicksand. The owners of the machine can give lists of places where it is used and methods of overcoming difficulties with special classes of materials. The possible capacity is much greater than that stated as observed with the machine at work in Indianapolis in the article referred to.

BOOKS ON GARBAGE COLLECTION AND DESTRUCTION.

I wish a work, the latest and best, on garbage collection and destruction.

E. N. WOODRUFF,
Mayor, Peoria, Ill.

Goodrich's "Economic Disposal of Town's Refuse," ($3.50), is an English book and the only one which gives anything like an adequate discussion of this subject. The English cities seem to be more successful than those in America, part of the reason for which may perhaps be found in the article on "Garbage Disposal," on page 28 of the January number of Municipal Engineering. Chapin's "Municipal Sanitation in the United States" ($5), has some good chapters on garbage collection and disposal, though too short.

MAKERS OF GARBAGE CREMATORIES.

Will you kindly give me the addresses of several firms making crematories, that is, devices for disposing of the garbage of cities?

F. P. ANDERSON, ——, Ky.

The Morse-Boulger Destructor Company, [illegible] Cortland st., New York City;

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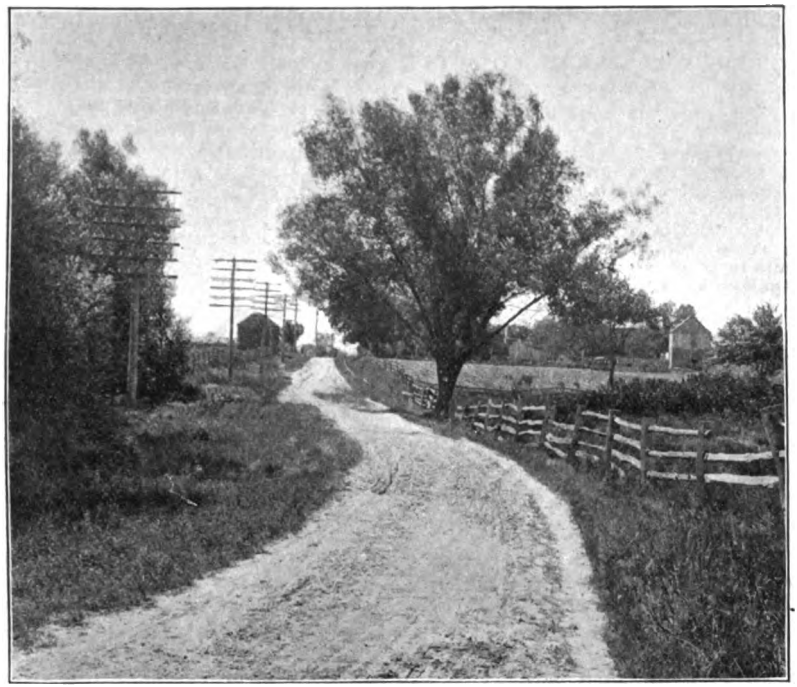

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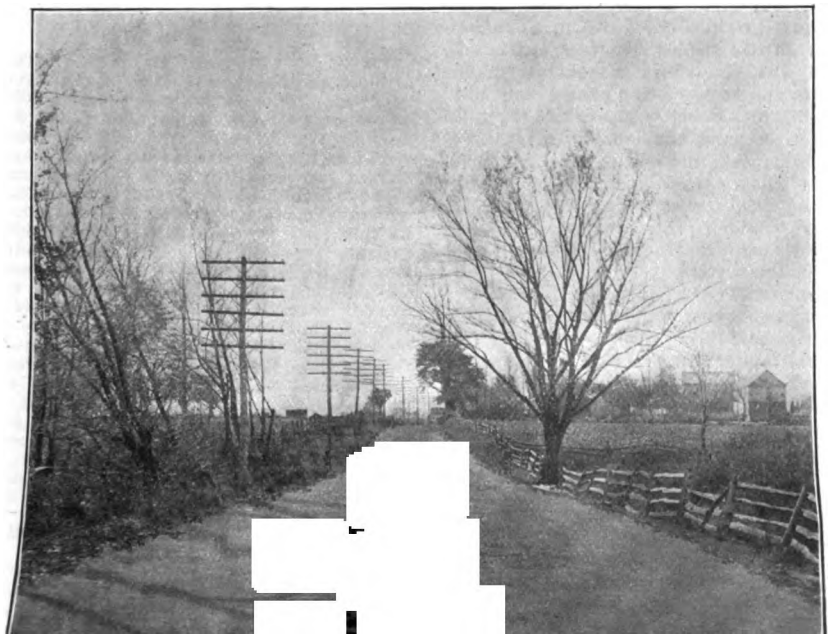

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BEST RAIL FOR STREET RAILWAY TRACK.

Can you give me information as to what kind of a rail is considered best from the municipal point of view for a street railway track on a street paved with brick? The street railway running through our street is using a 60-pound T-rail 4¼ inches high. The street is about to be paved with brick and the question presents itself whether it would be better to require the street railway company to put in a girder rail.

W. V. SAVICKI,
Village Engineer, Houghton, Mich.

For the integrity of the pavement it is quite necessary to have a rail of sufficient weight and depth to keep its position and not bend under the weight of the cars more than is required for elasticity of roadway, and to have these rails so supported that they will not settle or sink under the weight of cars at the points of support.

The Indianapolis Traction and Terminal Company has made a close study of this subject and many experiments have been tried with various pavements, foundations and rails. Their standard construction for tracks to be used by heavy interurban cars is described in Municipal Engineering, vol. xxv, p. 342, in a paper by Thos. B. McMath, the engineer of the company. It includes a 7-inch Shanghai T-rail on ties spaced two feet apart ballasted with six inches of concrete under the ties and between and above them to a level five inches below the top of the rail, an inch of sand cushion, special shaped nose brick next the rail to form a groove for the wheel flanges, and brick pavement between the tracks and for eighteen inches outside. This may be accepted as first-class construction for street railway in brick street. Even this construction gives some trouble from occasional settlement, looseness of rail joints, etc., which permit some movement of the rail vertically under the cars and a lifting of the bricks by the friction of the rail as it resumes its normal position, which finally displaces some of them. Any less complete construction will give more trouble and the choice must be made between the cost of first construction and cost of repairs.

The subject is discussed in other articles in Municipal Engineering, some of ments," vol. xii, p. 7, and xviii, p. 320; also in the Transactions of the American Society of Civil Engineers, 1897.

An answer to a similar question from a correspondent in the same town goes into some details not here considered. It will be found in vol. xviii, p. 249.

There is an excellent report on "The Construction of Surface Railroad Tracks in Paved Streets" in vol. xv, p. 348, which gives the practice in various cities and the reasons for many of the differences.

Perhaps the fullest discussion of the questions involved will be found in an article on "How to Lay Interurban Track in Cities" in vol. xxiv, p. 172.

Some track laid in Columbus, O., is described in an article on "Columbus Interurban Railway Construction," in vol. xxi, p. 69.

Methods of construction of street railways are given in some detail in an article in vol. xvi, p. 139.

Paving next to street railway tracks is described in an article on "Brick Paving from Start to Finish," in vol. x, p. 154.

The necessity of good foundation is shown in an article on "Street Railway Tracks on Paved Streets," vol. v, p. 271.

IMPROVEMENTS ON MACADAM ROADS.

Our city is about to take up the matter of building about a half mile of macadam roadway. The plans and specifications have not yet been made, and it has occurred to some of us that perhaps there might be a much better road which could be had for very little more expense than the old-fashioned rock road. Heretofore we have made our streets of brick, but as this road is to be built at the public expense instead of by assessments against the property, and as it will pass through the outer part of the city, we do not care to make it too expensive. Our old macadam roads were simply a lot of crushed stone thrown on the surface of the earth after the ground had been leveled off a little. Is there not an improvement on that system? I understand that now in some places they put in drain tile and large stone on the bottom and then spread on the macadam.

Please advise as to where we can learn about the improved roads and also get an idea as to their cost.

D. D., ———, Ill.

It is hardly proper to call a road made

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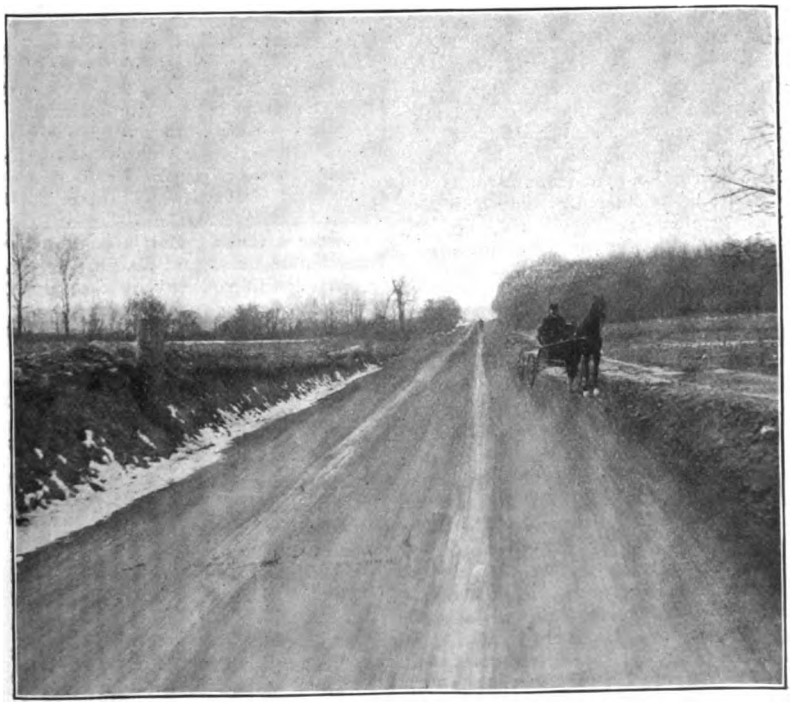

After Improvement.
NEW JERSEY PUBLIC ROADS.
River Road, Camden County.

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grade should be thoroughly compacted by rolling and soft places should be dug out and replaced by good material. On top of this foundation a proper thickness of broken stone should be placed, and it is customary to place the larger sizes at the bottom, finishing the wearing surface with fine material thoroughly washed and rolled in so that the surface will be as nearly waterproof as possible.

In some places the bottom layer of stone is of large enough size to lay by hand in the form of a rough pavement. and enough of the finer broken stone or gravel is laid on top to make a good wearing surface, which can be renewed as it wears out. This is called telford pavement, or telford macadam. Novaculite can be used for the wearing surface.

Experience with macadam roads in Illinois, in one case of novaculite, shows that there is great danger that the sticky mud from the unpaved road at the end or intersecting the macadam road will stick to the wagon wheels and pick up the stones from the macadam and carry them away, thus destroying considerable sections of the road within a few weeks or months. Unless the macadam is thoroughly compacted this is almost certain to happen with the sticky clay of the Illinois prairies and is possible with the best construction.

Some material to hold the stones in place is needed to overcome this action of the mud, and bituminous macadam is suggested for consideration in case this trouble may be expected.

The construction of macadam roads and pavements is considered at length in Municipal Engineering, vol. xxiii, pp. 372, 374, 375 and 383, and of bituminous macadam on p. 377. Specifications for telford macadam will be found in vol. x, p. 405. Specifications for macadam roads will be found in vol. xviii, p. 168.

Figures as to cost will be found in vol. ix, p. 107; xiv, p. 222; xvii, p. 80; xxi, p. 159, which also gives a list of previous articles on the subject of macadam.

The bituminous macadam or bitulithic pavement is fully described in vol. xxv, pp. 99 and 325. Further information, and lists of articles on the subject, will be found in vol. xxv, pp. 27 and 377.

Books giving treatment of the subject of macadam pavement are Baker's "Roads and Pavements" ($5), Judson's "City Roads and Pavements" ($2), Alt-

FOUNDATION FOR BRICK PAVEMENT.

A communication from the Shinn Slag Sand Company, Pittsburg, Pa., calls attention to the statement regarding the use of sand for cushion under brick wearing surface in Municipal Engineering, vol. xxiv, p. 361, which says, "It is especially so if any of the sand is likely to leak into the foundation, for the less the thickness of cushion the less unevenness in brick surface from its disappearance." The communication calls attention to slag sand as a material for the sand cushion because "when common sand is used for this purpose it will flow into the crevices between the gravel and stone when the sand is either dry or supersaturated, leaving the brick unsupported," "one of the prime causes of failure in brick paving," while slag sand will not flow under either of these conditions, but will set into a sort of concrete adhering to sub-foundation and to brick, and hardening into a part of the superstructure.

COST OF ASPHALT PAVEMENT.

I would like to learn the cost of asphalt pavement in the different large cities of the United States. Can you refer me to the sources of such information?

HENRY C. WRIGHT,
Cincinnati, O.

The volumes of Municipal Engineering are the best sources of this information. Beginning with the latest, the following articles which have appeared in the past six years will give the fullest and best information. There are many shorter articles giving special figures for particular times and places.

Articles in vol. xxvi, pp. 10 and 16 and vol. xxv, p. 435, give a discussion of some estimates of cost for a municipal plant and figures of actual cost. In vol. xxiii, p. 117, will be found some bids from Philadelphia. In vol. xxii, pp. 150 and 176 are figures of cost under municipal construction in Winnipeg; on p. 401 are data regarding cost of asphalt pavements in Iowa cities. In vol. xx, p. 132, is a large table carefully prepared by City Engineer Bardol of Buffalo giving cost of pavements in many large cities, the table being editorially discussed on page 146. The cost in Newark N. J., is given in vol. xix, p. 297. A large table prepared by City Engineer Gray of Providence, R. I.,

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prepared by a committee of the American Society of Municipal Improvements will be found in vol. xiv, p. 18 and another report from the same society in brief in vol. xiii, p. 366. The cost of asphalt repairs is given in many short articles including vol. xx, p. 97, regarding Buffalo, p. 129 regarding Chattanooga and in vol. xvii regarding several cities.

Honest and fair statements will be found in the annual volumes of proceedings of the American Society of Municipal Improvements, the National Municipal League and the League of American Municipalities. There is scarcely a number of Municipal Engineering which does not contain some information concerning several cities of the size mentioned.

NEW JERSEY PUBLIC ROADS.

River Road in Camden County After Improvement, Showing Cribbing on Both Sides.

CONDITION OF MUNICIPAL PUBLIC WORKS IN LARGE CITIES.

Where can I get full and recent reports concerning the actual condition in cities of over one hundred thousand population of pavements, street cleaning, water works and other public works? I desire to get all possible information concerning any failures and shortcomings in these departments.

F. L. INKS.
Mount Vernon, Ia.

The papers and reports which are devoted to the shortcomings of municipal departments are too often written for a special purpose and are biased by the desire to make some point such as our correspondent apparently wishes to make. A study of the annual reports of the various departments by one who is familiar with good and bad practice is the best method of selecting the places where improvements might be made, but even then personal investigation on the spot may change one's opinion.

Our correspondent is to debate a question which in short is a resolution that cities of the size named should own and operate their water works, lighting plants and street railways. Some will draw the line of ownership inside this list, some one side and some the other. Discussions of the place to draw the line will be found

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ELECTRIC LIGHT SCHEDULES OF CITIES.

What cities between 150,000 and 200,000 population pay for electric lighting on all-night schedules?

FRANK S. FISHBACK,
Indianapolis, Ind.

Of the five cities of the size mentioned Providence, R. I.; Rochester, N. Y., and St. Paul, Minn., have all-night schedules for electric lighting and Kansas City, Mo., and Indianapolis, Ind., do not.

LIST OF CEMENT MANUFACTURERS.

I would most respectfully request you to be so kind as to furnish me with a list of a few good cement manufacturers, as I expect to go into business in a few months. L. J. K., Buffalo, N. Y.

The "Directory of American Cement Industries" ($5) contains a full list, giving all the present and prospective manufacturers of cement whose companies have been organized. The list gives the ratings of the companies as to capital and credit, the number of barrels of cement manufactured, the capacity of mills, the kinds of cement manufactured, the processes used in the manufacture, brief yet full descriptions of works, names of brands, and sales agents, in short, everything that would be necessary to enable one to select a satisfactory list for the purpose for which our correspondent desires it.

The third edition is now in the printer's hands and will be pushed through the press as rapidly as possible, being issued, probably in March.

THE BEST CONCRETE BUILDING BLOCK MACHINE.

Lime and Plaster, describing methods of manufacture.

Freight Rates on Cement, giving rates from factories to principal distributing points throughout the country.

Descriptions of Works and of Processes for the Manufacture of Cement, giving brief but comprehensive statements of the processes and machinery used in each cement factory in operation in the United States and Canada.

The book is thus seen to be the most

Could you tell me who makes the best concrete building block machine?

F. G. S. St. Marys, Pa.

It is hardly possible for this magazine to select the best machine for any particular user's purposes. The most prominent machines have been quite fully described in Municipal Engineering from time to time. A list of the articles containing these descriptions will be found on page 21 of the January number.

References may also be made to our advertising pages. All of those represented with which the writer is acquainted have their points of special value and one who wishes to go into the business of making and selling blocks or who wishes to purchase for his own use should determine what he wants and select the machine according to his needs and desires or the conditions of the trade which he must meet.

THE HANDBOOK FOR CEMENT USERS.

Kindly let me know if your "Handbook for Cement Users" contains any information on the design of cement concrete-steel construction, the determination of stresses and proportioning of the parts, etc. Kindly let me know the price and send table of contents if possible.

J. DE BRUYN KOPS,
Sa annah, Ga.

The "Handbook for Cement Users" ($3) does not contain a discussion of the subject of the design of concrete-steel construction from the standpoint of the computer of stresses and of dimensions. In fact there is no book in English upon this subject. Various engineers connected with firms introducing methods of steel reinforcements have published papers upon various phases of the subject, some of them as presented to engineering societies and some as prepared for the advertising literature of their companies. There are as yet but few tests of construction to determine the correctness of the formulae deduced and no one has yet taken up the question in an unbiased way. Howe in his "Arches" (4) and Cain in his "Concrete-Steel Arches" (50 cents) have given theoretical consideration to this particular form of concrete-steel.

The "Handbook for Cement Users" is now published separately from the "Directory of American Cement Industries" ($5) and the former can now be obtained for $3. It contains the following chapters:

Introduction, giving a review of the development of cement manufacture and statistics of production, price, etc.

Testing of Cement, giving the methods recommended by the American Society of Civil Engineers, the Corps of Engineers, U. S. A., etc., including chemical analysis.

Specifications for Cement, giving many sample specification by the United States Engineers, various railroads and cities, and for many special uses.

The Uses of Cement, describing methods of designing mixtures of cement for various uses and the results in strength and cost, as well as many special methods

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of constructing foundations, pavements, sewers, arches, reservoir linings, piers, dams, etc., including coloring and special treatments.

Specifications for the Use of Cement, giving specifications used by contractors, cities, railroads, government engineers, and others for arches, piers, foundations, conduits, reservoirs and linings, walks, curb, pavements, floors, sewers, buildings, cisterns, plastering, masonry, etc.

Data for Estimates of Cement Work, both quantities of materials and cost.

Cement Laboratories, describing typical private, municipal and college laboratories.

complete yet published upon the practical use of cement, and the clearest guide to the construction of specifications for concrete work. It is not a book upon the design of structures, but it is a full guide to the use of cement and concrete in such structures.

MUNICIPAL MATTERS IN COURT

Higher Courts—Water Company Pays Fire Loss—East Chicago Water Company—Defective Meter—Water Bond Issue—Remonstrances—Michigan Road Act—Anderson Improvements Enjoined—Forfeit for Delay—Bay State Gas Company.

Abstract from Decisions of the Higher Courts on Matters Relating to Municipal Improvements.

Prepared by Russell T. Byers, LL. B., Indianapolis, Ind.

Assessments—Benefits—Front-Foot Rule The validity of an assessment must be determined by a rererence to the law in force at the time the improvement was ordered. The Council's judgment as to what property is benefited is conclusive in the absence of fraud or gross mistake. The adoption of the frontage rule in determining the amount of the assessments does not vitiate the assessment. Where the plaintiffs do not own the property improved they can not attack the validity of the assessment on the ground that the city is not the owner. Beck et al. vs. Holland et al., 74 Pac. R. (Mon.) 410.

Assessment—Front-Foot Rule—The statute providing that tne amount of an assessment shall be determined by the front-foot rule is not unconstitutional as a taking of private property without due process of law. Deane et al. vs. Indiana Machine and Construction Company, 68 N. E. Rep. (Ind.), 686.

Assessments — Description of Work— An improvement resolution must "inform the citizens, substantially of the kind and character of improvement." The statute also makes it imperative that the resolution of the council shall set out where the grade line is to be. It is also necessary, before any contract is let, that an estimate of the cost of the contemplated improvement shall be made by the city engineer. City of Kirksville ex rel. Fleming, etc., vs. Coleman, 77 S. W. Rep. (Mo.), 120.

Assessments—Hearing—Front-Foot Rule —The City Council in providing that a hearing should be given after an improvement was ordered, to receive objections to the assessments, also for an appeal from the decision at such hearing, complied with the statutes. The frontage rule is a reasonable basis for determining the amount of an assessment in the absence of a showing that the property is not benefited to the extent of the assessment. Adams vs. City of Roanoke, 45 S. E. Rep. (Va.) 881.

Assessment—Fraud Defined—When an improvement has been regularly approved by the common council such approval, in the absence of fraud, is conclusive upon the abutting property owners. What is fraud under such circumstances is considered in this decision. Lux etc., vs. Donaldsoon et al. 68 N. E. Rep. (Ind.) 1,014.

Assessments — Original Construction —

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Where repairs are made on that portion of an old turnpike road which has been brought into a city by the extension of its limits, these repairs do not constitute such an original construction as to relieve abutting property-owners from an assessment for a subsequent improvement. The council had the power to determine the manner of assessing the cost. Where a street which was to be improved had been previously improved along part of its distance by original construction the city has a right to pay out of the funds of the city for that portion which they reimprove. Wymond et al. vs. Barber Asphalt Paving Company, 77 S. W. Rep. (Ky.) 203.

Assessments of Railroad Right-of-Way —A strip of land taken by a railroad company, under its right of eminent domain, and used as a right-of-way, which is a "lot" within the statute governing street improvements, is liable for an assessment for a street improvement. Louisville & Chicago Railway Company, vs. Barker, etc., 76 S. W. Rep. (Ky.) 1097.

Assessments—In an action to restrain the city from collecting the second installment for local assessment, the first having been paid, it was held that the failure to include an itemized engineer's estimate in the ordinance is a jurisdictional question, and under the statute, should have been raised and determined at the time of the payment of the first installment. Treat vs. City of Chicago, et al., 125 Fed. Rep. (Ill.) 644.

Assements for Sidewalks and Intersections — In determining the amount of the assessment for certain sidewalks, the linear foot rule was adopted. Property-owners had the privilege of building their own walks, in which event they should be liable to assessment only for their pro rata of the cost of the intersections. Held—That the construction by the property-owner of the intersections did not relieve him from such assessment. Herman Construction Company vs. McManus, 77 S. W. Rep. (Mo.) 810.

City—Powers—Water Works—Sec. 3,541, Burns' R. S., 1901, provides that a city may become a stockholder in a water works corporation by subscribing to its capital stock and may borrow money to pay its stock subscription. Purporting to act under this enactment of that the water company, previously incorporated, should be permitted to operate a water works system for twenty-one years; that the city should purchase 30,000,000 gallons of water per month, etc., etc.; should furnish the steam to operate the plant; that it should "pledge the income and revenues of its water works system for the payment of water rentals, and levy a tax sufficient to amply supplement said incomes and revenues." It also provided that in the event the city should issue bonds that it should pay the said water rentals to trustees to secure said bonds. The court held that municipal corporations may exercise only such powers as they are invested with by the Legislature, and such other implied powers as are reasonably necessary for the carrying out of the powers expressly conferred. The court also held that the power to contract for 21 years to pay for 30,000,000 gallons of water per month, whether used or not, to furnish the motive power for the plant, and to pay rentals to trustees, in the event of the issue of bonds, was the exercising of powers not expressly granted or reasonably implied. Such provisions render the city practically a guarantor of the water company. The court intimates strongly, however, that in Indiana a city may install a water plant for the benefit of the public generally, and that it may aid to a reasonable extent a private corporation to furnish water to the inhabitants. Scott et al. vs. City of Laporte, 68 N. E. Rep. (Ind.) 278.

Defective Work—Right of Taxpayer— The plaintiffs are citizens and owners of real estate abutting upon Sprague-st. The suit was brought to prevent the city from paying for or accepting certain paving done upon Sprague-st. for the reason that the work did not conform to the contract between the city and the paving company, and because the materials used were of inferior quality. It was held that the specifications and the written contract are the evidences of the agreement of the parties and the work must conform to them. The work in this case did not come up to the requirements of the contract and the injunction of the citizens was made perpetual. Pleasants et al. vs. City of Shreveport et al., 35 So. Rep. (La.), 283.

Gas Mains—Suit to Prevent Laying of

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Grading By Owner—Damages—Estoppel An owner of property on both sides of the street secured permission to pave the street in conformity to the grade line, etc. After completing the grading he sued the city because he had been compelled to conform his pavement to the grade line, which was higher than the natural surface. The court held that he was not compelled to construct the pavement at all, and that the permission was granted for plaintiff's benefit and upon condition that he conform to the line. Having accepted the condition he is bound. Devlin vs. City of Philadelphia. 56 Atl. Rep. (Penn.), 21.

Powers—Lighting Streets, Etc.—A city has implied power to light its public streets and public buildings and places. When a city has the power to provide for public heating and lighting it may do so by the erection of plants. The cost of the construction of water and electric light plants, is a "necessary expense" within the meaning of the constitution, art. 7, sec. 7. Fawcett et al. vs. Town of Mt. Airy, 45 S. E. Rep. (N. C.) 1029.

Improvement — Invalid Supplemental Contract—Quantum Merult—Where a contractor acting under an invalid supplemental contract, constructs certain public improvements, the city is liable for the reasonable value of the additional benefits conferred. City of Chicago vs. McKechney et al., 68 N. E. Rep. (Ill.) 954.

Reassessment—Alien Labor Clause—A void ordinance cannot serve as a basis for a new ordinance calling for a new assessment. A statute which provides that contractors shall not employ aliens is void as being an interference with the right to contract. City of Chicago vs. Hulbert et al., 68 N. E. Rep., (Ill.) 786.

Special Tax Bills — Limitations of — Under the Kansas City charter, art. 9, sec. 23, though a default in the payment of any installment of a special tax bill may mature the entire bill, yet the statutory limitation of one year, during which time the bill is a lien, does not begin to run until one year after the last installment becomes due, as indicated upon the face of the bill. Barber Asphalt Paving Company vs. Meservey. 77 S. W. Rep. (Mo.) 137.

Water Works—Damage to Land—The petitioner sought to recover for damages to property not taken but injured by the acts of Metropolitan Water Board. In this case part of the real estate damaged was within and part without the prescribed boundaries. Held that the statute intended to affect only the property within the prescribed boundaries; also, that the draining of a well, which lay without the boundaries, is a damage that may be compensated for under certain sections of the act. McNamara vs. Commonwealth. 68 N. E. Rep. (Mass.) 332.

Water Company Must Pay Fire Loss Caused by Cutting Off Water Supply.

A jury verdict returned Jan. 13 awarded the Buchanan & Smock Lumber Company of Asbury Park, N. J., $31,000. The company brought suit against the East Jersey Coast Water Company for $42,000 damages resulting from the failure of its hydrants to feed the hose at a fire which practically wiped out the lumber yard in October, 1902. The lumber company, before it was incorporated, made a contract with the East Jersey Company for the rental of two hydrants near its yards, with the provision that the plugs should be supplied by the company with water for use in case of fire. On Oct. 30, 1902, a fire occurred and the plugs were found quite dry, and the damage that followed was estimated at $42,000. Owing to a disagreement with another patron over the payment of a bill, the water company had shut off the main which supplied him, and in doing so had also deprived the lumber company of its expected supply. The water company alleged that the firemen did not know how to operate the hydrants and that the plaintiff corporation had recovered its fire loss through the payment to it of insurance money. Justice Fort ruled, however, for the benefit of the jury, that this point in no way affected the principle of liability at issue. Before the case went to the jury the plaintiff company announced that the amount of damages demanded had been reduced from $42,000 to $35,000, the deduction being for the $7,000 insurance which had been recovered.

The attorneys for the East Jersey Coast Water Company immediately gave notice of appeal.

East Chicago Water Company's Difficulties.

Judge Anderson of the Federal Court at Indianapolis on Jan. 6 ordered the city of East Chicago, Ind., to pay to the receiver for the East Chicago Water Works Company, dating from Nov. 12, 1903, $55 a year for each of the 163 fire hy-

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drants used in that city, and $92.80 for each of the 56 arc lights. In addition all money received for the private consumption of water and light since the receiver was appointed must be accounted for to the receiver. Judge Anderson ordered the costs of the appearance and decree of the court adjudged against E. W. Wickey, city attorney of East Chicago.

City Responsible for Defective Meter and Its Record.

The Appellate division of the New York Supreme Court handed down a decision, Jan. 15, affirming the judgment of the lower court in granting Thomas J. Healey an injunction restraining the city of New York from cutting off his water supply because of his refusal to pay a water bill presented by the city. The evidence submitted showed that the water inspectors examined the meter in Healy's place and broke the official seal, which they found intact. They discovered that the teeth of a cog wheel attached to the dial had been so filed down that the meter only registered one-fifth of the actual amount of water consumed. The Appellate division holds that since there is no proof that Healy had anything to do with the fraud in the meter the city is bound by the figures on the meter dial, be they right or wrong. The dismissal of the city's suit to recover the bill is also affirmed.

Cincinnnati's Supplemental Water Works Bond Issue Valid.

An oral decision issued by the Circuit Court at Cincinnati, O., January 8, upholds the position of Judge S. W. Smith that the supplemental issue of water works bonds is valid. The suit was brought by City Solicitor Hunt on request of Theodore Horstman, who sues as a taxpayer, and who attacks as unconstitutional the issue of $2,000,000 bonds supplemental to the issue of original construction bonds. He alleged that it was special legislation; that the act providing for the construction of water works under valid, the supplementary act and the issue thereunder must also be held valid. The Circuit Court dismissed the petition on appeal from this decision, affirming it as correct.

Who Can Sign Remonstrances Against Paving and When.

The Court of Appeals at Kansas City, Mo., handed down a decision Jan. 4, in the case of the city of Sedalia vs. Jennie R. Scott. The suit is based on a special tax bill for street paving, in which a majority of the property owners filed a remonstrance with the city clerk against the paving of a street within ten days after the publication of the resolution proposing the work. After the remonstrance had been filed, however, several of the remonstrants withdrew their names, leaving, apparently a minority remonstrance petition. Judge Ellison decides that after a remonstrance has been filed with the city clerk no name may be withdrawn. He points out, however, that a name upon a petition may be withdrawn before the instrument is filed with the city clerk. The tax bills are, therefore, declared invalid. The court decides in the same opinion, that administrators have no right to sign remonstrances and petitions for estates in street improvement work.

Saginaw County Mich., Road Act Void.

An opinion handed down by Judge Snow of the Circuit Court at Saginaw, Mich., holds the county road act void. The opinion was rendered in the case of the Board of Supervisors vs. John G. Hubinger, supervisor of the township of Frankenmuth, asking that he be compelled to spread the road tax on the rolls of that township, as provided by local road act of 1899. The refusal of Frankenmuth township to recognize the Saginaw County road act as applicable to it has caused considerable friction. The contention of the township is that it is exempt under the county act, having established a road law of its own under pre-

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Council from settling finally with the contractors for making improvements on Sherman-st. until they are completed, according to specifications. When the matter came up in Council interested property owners remonstrated, claiming that the work had not been properly done. The work will now have to be done over.

A Suit for Forfeit for Delay in Completing Contract.

An answer has been filed in the Federal Court by the city of Salt Lake, Utah, in the suit brought by the Alcatraz Asphalt Paving Company, in which judgment against the city in the amount of $7,850 is asked on account of an alleged balance due on a paving contract. Various amounts were paid at different times on the contract for grading, curbing and paving Second South-st., from First West to Sixth West, and Third South-st., from State to West Temple-st. Upon the completion of the work, on Nov. 22, 1902, there was a balance due the company, it alleges, of $23,784.21. In making the settlement, however, council retained out of the total contract price the sum of $7,850 as a forfeit for 157 days' delay in completing the work, and it is for the recovery of this forfeit that the paving company brought suit. In its answer the city makes denial of all allegations in the complaint which attack the right to retain the forfeit money.

Duties of the Bay State Gas Company.

The Delaware Supreme Court has rendered two decisions connected with the Bay State Gas Company. In one case the court decided against the appeal of the Bay State Gas Company in the suit brought by Henry and Walter Content of New York City, who are stockholders, and tried to gain access to the books of the company at Wilmington. They secured a writ of mandamus. J. Edward Addicks, president of the Bay State Gas Company, appealed to the Supreme Court, which decided against him.

In the second case the Bay State Gas Company refused to file with the Secretary of the State of Delaware a certificate stating the condition of the company. The court sustained the company in this case on the ground that it was chartered under a special law prior to the enactment of the present general corporation laws, which require such statement to be filed.

SEWERAGE AND SEWAGE DISPOSAL

Bedford Sewerage—Filters and Contact Beds—Minnesota Stream Pollution—Pulp Mill Pollution—New York State Water and Sewer Board—Exclusive Garbage Contract.

Sewerage and Sewage Disposal at Bedford, Ind.*

By G. C. Houston, City Engineer.

Some years ago, shortly after assuming the duties of City Civil Engineer of Bedford, Ind., it became apparent that a system of sewers was fast becoming an absolute necessity.

The place was fast growing from a straggling country village to a little city of several thousand inhabitants and the crude methods then in use for disposing of wastes were found to be no longer sufficient. Epidemics of typhoid fever, diphtheria and other diseases began to make the people realize the necessity of getting the city into a better state of cleanliness.

Various plans were proposed and some investigations were made, but for some time nothing definite was arrived at. It was finally decided that a system of strictly sanitary sewers should be constructed. The city, some time before, had built sewers for carrying off the storm.

*From a paper before the Indiana Engineering Society.

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water at such places as were at that time needed so that there was no necessity for conveying surface water into the sewers built for conveying away foul sewage.

Surveys were made of the streets and alleys and profiles made showing the surface of the ground and the grade of the flow line of the sewers; also location of street and alley intersections. A map was also prepared showing the territory proposed to be drained. This map showed the street and alley lines, the location and diameter of the proposed sewers and the location of all manholes, flush tanks and junctions.

Owing to the hilly surface on which Bedford stands only a part of the city could be made to drain into any one system of sewers. The part selected for the present system embraces nearly all the northeastern portion of the city. The public square and the streets leading east, west and south, and the territory lying between the Monon railway and Spider creek, embracing about half of the area of the city and perhaps two-thirds of the population. This territory is known officially as sewer district No. 1.

Starting at the outlet at the south line of the corporation the main sewer runs in a northerly direction over private ground and various streets and alleys to the intersection of K-st. with the alley between Sixteenth and Seventeenth-sts. This main is fifteen inches in diameter. At the point spoken of the main divides into two mains each twelve inches in diameter. One branch going west on the alley above mentioned to its intersection with M-st., thence north on M-st. to the alley between Fourteenth and Fifteenth-sts., where it decreases to ten inches in diameter and continues north on M-st. to the alley between Twelfth and Thirteenth-sts., where it branches into three laterals.

The other branch goes east on the alley between Sixteenth and Seventeenth-sts. to J-st., thence north on J-st. to the manhole at Thirteenth, where it enters a cast iron riveted siphon which extends about 800 feet to a point near the southwest corner of the Southern Indiana Railway Station, where it enters a 10-inch terra cotta pipe and runs east to I-st., thence north to Ninth-st., where it branches into two laterals which extend north to the corporate limits of the city.

Laterals connect with these mains and extend as far as the nature of the ground will permit.

Altogether there were laid 27,740 lineal feet of 8-inch terra cotta pipe, 2,350 lineal feet of 10-inch terra cotta pipe, 2,720 lineal feet of 12-inch terra cotta pipe, 1,240 lineal feet of 15-inch terra cotta pipe, 800 lineal feet of 8-inch cast iron pipe and 1,220 lineal feet of 10-inch cast iron pipe. There are nineteen flush tanks and eighty-six manholes. Wye junctions were placed so as to provide connection for each piece of property and to provide for contingencies.

The prnciple laid down by the late George E. Waring, jr., were in the main followed, except in the use of eight-inch in place of six-inch laterals and in the more extensive use of manholes. These changes were deemed advisable from personal experience some years ago at Pueblo, Colo., also by correspondence with public works officials at San Diego, Cal., and other places. Col. Waring himself admits that there is no objection to the use of 8-inch pipe except the cost.

The inverted siphon spoken of above was put in to bring the sewer across a ravine near the Southern Indiana station. The sewer on leaving the manhole enters an 8 cast-iron pipe at an elevation of 274 above return and runs 370 feet to a gate valve at an elevation of 246, thence 430 feet to the manhole at Thirteenth-st. at an elevation of 269.54, where it re-enters the terra cotta pipe on J-st. The gate valve is placed at the low point to provide for flushing in case of stoppage.

Great care was taken with the grade and alignment so as to have no crooks or depressions. Stakes were driven at every fifty feet or half station on the surface and the cuts from the top of the stakes marked. When the cut was nearly completed finishing stakes were driven to the grade of the flow line at distances varying from ten to fifteen feet, according to circumstances.

The flush tanks made by the Pacific Flush Tank Company of Chicago were used. Wherever possible the Standard Miller tanks were put in, but in some places, owing to light cuts, special designs adapted to shallow depths were used.

Bedford is situated about three miles from the east fork of White river and is about two hundred and fifty feet above low water in that stream. A high stone ridge lies immediately south of the corporation line and between the city and the river, making it practically impossible for the sewer to have an outlet in that direction, even if it had been so desired. It was suggested that an outlet might be had by cutting through to Leatherwood creek on the east or to Spider creek on the west for an outlet, but as those streams are scarcely more than a succes-

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sion of pools in dry weather the consequence of emptying the foul sewage of a city of eight thousand people may well be imagined.

White River and its various branches above Bedford receive the drainage from Brownstown, Seymour, Columbus, Greensburg, Vernon, North Vernon, Scottsburg, Franklin, Edinburg, Shelbyville, Rushville, Knightstown, New Castle, Carthage and Greenfield, besides numerous smaller towns. Some of these places contain factories of various kinds such as strawboard works, tanneries, etc., which empty their refuse into the river. Some of them are places of several thousand people, and have sewers that empty their filthy contents into the river without any purification, whatever, converting that which the Almighty made pure into deadly poison. The writer once stood on the bank of the river at Columbus and watched the sewage of that city discharge into the water. He had never believed that water running two miles would purify itself, and the sight of that filthy sewer confirmed him more fully in his belief that the emptying of filth into the streams was wrong and that something ought to be done to cause it to be discontinued.

The water supply for the city of Bedford is taken from the river below the city and should the sewage by any means be carried to the river it would of necessity empty above the intake of the water works, but with the refuse of the towns above mentioned flowing into the river it was taken for granted that the water in the stream was already sufficiently charged with filth and bacteria for all practical purposes.

It was, therefore, decided that the sewage should be purified before being turned loose on the people living below town, and the well-known firm of Alvord & Shields of Chicago was employed to design a sytem of purification works. Upon their advice a septic tank was located on the bank of a small stream near the south line of the corporation just east of the Monon Railway. At this point there is a group of sink holes. This stream receives the surface water falling on the central and a portion of the western parts of the city, and empties its waters into the sink holes just north of the high ridge above spoken of.

The tank is seventy-six feet long and twenty-one feet wide on the outside. The lower part to a short distance above the water line is built of concrete, while the upper part is built of brick and covered with galvanized steel. On top of the roof a ventilator extends about two-thirds the length of the building. Four windows are placed on each side while each end is provided with an ordinary door. The interior is provided with four concrete baffle walls and two concrete gutters. These walls and gutters are supported by iron rods extending into the concrete side walls and securely anchored. A sludge valve is placed about six feet from the upper end of the tank, to be opened only when the tank requires cleaning. An outlet is provided at about two-thirds of the way from the inlet end and another one at the lower or outlet end. A wooden walk extends the full length of the tank on the west side

The sewage coming toward the tank enters a diversion manhole near the upper end of the tank under sufficient pressure to force the sewage into the tank.

It passes under the first three baffle walls and a part of it passes into the concrete gutter and leaves the tank through a ten-inch opening. The remainder passes under the fourth or last baffle wall and passes into another gutter and leaves the tank near the southwest corner. The sewage thus treated passes into one of the sink holes mentioned above. What becomes of it after passing into the sink hole is a problem that is as yet unsolved, but most likely it passes deep into the earth. Time will no doubt demonstrate what finally becomes of it. The city owns ample grounds on the west side of the tank for the building of filter beds and should the working of the tank not prove satisfactory the beds will be built later on as the occasion may require.

When this work was commenced there was no plant of like character in Indiana and I believe even now it is the third one in the state, and to some extent it is an experiment. I am convinced that we have begun to move in the right direction and hope that the day is close at hand when cities and factories will no longer be allowed to send foul sewage into the streams to spread disease and death on the inhabitants of places lower down.

Filters Versus Contact Beds In Sewage Purification.*

By W. S. Shields, C. E., Chicago, Ill.

There has been so much written about the septic tank that I only note as introducing my subject that there is much about them that is unknown. Its use is now universally admitted to be essential in the present practice of bacterial purification, although when men like Douglas Archibald of England present such for-

*From a paper before the Indiana Engineering Society.

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midable arguments backed by actual results in favor of chemical precipitation as a preliminary treatment to filtration where large quantities must be handled, his claims must and will receive consideration. The preponderance of opinion, however, is in favor of the tank for liquifying the solids and preparing the sewage for final nitrification.

Generally speaking, our knowledge of these vegetable growths, or bacteria, is that there are three general classes which bring about the purification of organic waste; first, the anaerobic or liquifying bacteria which in the presence of oxyder conditions where oxygen does not exist; second, the aerobic or non-liquifying becteria which in the presence of oxygen produce decomposition, and third, the facultative bacteria which may be either anaerobic or aerobic in their nature. Each of these classes is composed of different species, each having its specific functions and operating on the different component parts of the sewage. It is from a close study of these classes and their species that we can hope to improve upon or get the greatest efficiency from the septic tank and it is to the bacteriologist that we must look for advice in this direction.

The English practice is to build tanks with a capacity of from 1 to 1½ times the daily flow and expect the effluent to contain less than one part of albuminoid ammonia, while the American engineers design their tanks for from ½ to 1 times the daily flow.

The treatment of the septic tank effluent is the most interesting feature at the present stage of the science, and it is receiving a very careful study from experts who will in a few years be able to give us reliable information and data on this part of the work. Until then, we must be guided by the experience and results obtained by those who have carefully and methodically designed works which have been put into operation, and who are able and willing to give results secured, or if failures are encountered the reasons for such, that others may avoid like disaster.

The result to be obtained is to take the septic tank effluent and to further purify it by oxidation and nitrification so that there may be no nuisance created or damage done by discharging it into the most available water course.

In some cases where sufficient running water is available the effluent may be most generally, however, such streams are not available and some artificial means must be adopted, and this in the present practice, means either contact beds or some type of filters; and it s particularly this feature of the problem that I wish to call attention to.

The English engineers who were the first to recognize and adopt the bacterial process as such, have had a much wider and more varied experience with the different forms of filters and bacterial beds than we have had; consequently much importance must be given to the results which they have been able to obtain. With them the contact bed originated, as well as a number of the different forms of bacterial filters which are now being used.

The contact bed, which was the first form of anaerobic treatment, is perhaps the best known of their methods. A large number of plants have been equipped with these beds and even in America, we have quite a number of plants designed after the same general principles first adopted in England. Experience and a more thorough knowledge of the principles involved have resulted in improved methods until at the present time the contact beds are losing their popularity and are being crowded to the background in favor of other forms of filters in which more positive aerobic action can be secured and at a less expense.

It is interesting to note that at a recent meeting of the Sanitary Institute at Birmingham, England, a great majority of the speakers expressed themselves as being against the adoption of contact beds; some of them even pronouncing them back numbers and out of date. It is not strange, however, that this should be so, as it is expected that the first methods adopted to accomplish a certain result are subject to improvements and if the contact beds have only been a stepping stone to something better, they have accomplished useful results.

The present English practice is now running largely to open filters, variously termed percolating, aerating, intermittent, streaming filters, etc., all much alike in general character and differing mostly in their construction and method of application.

The contact bed requires practically water-tight tanks, which are quite expensive, and to get best results there should be a double contact with a maxi-

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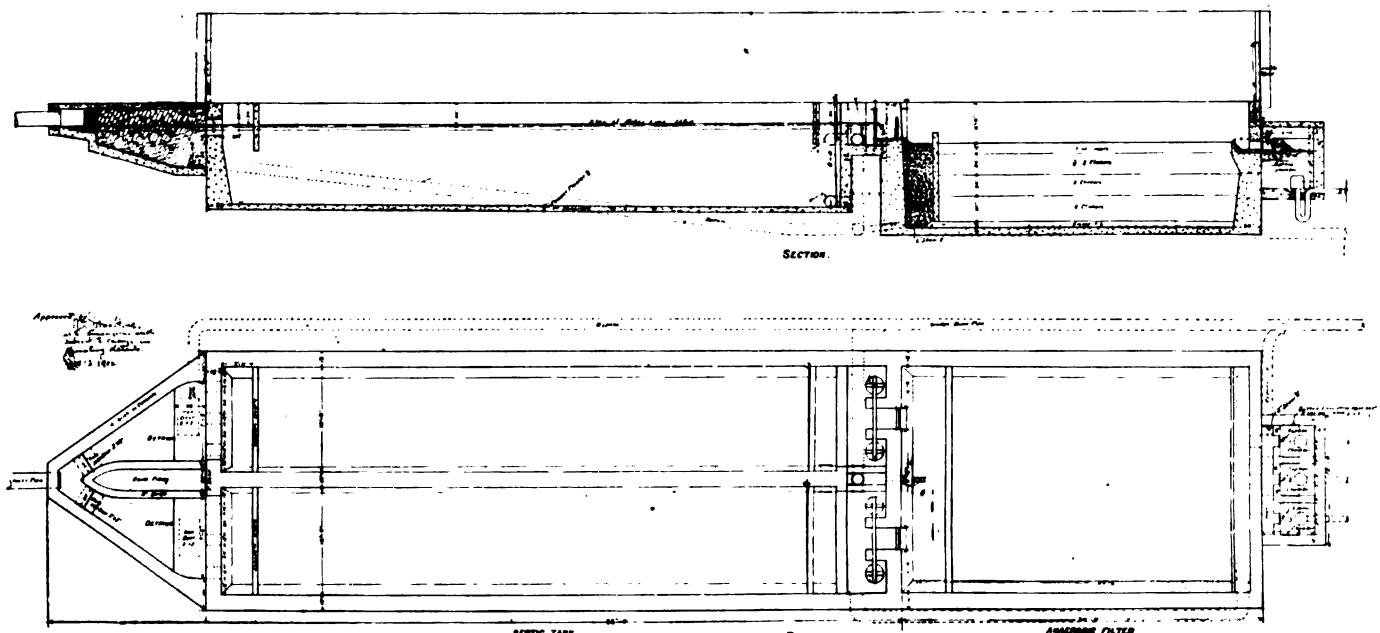

WEST ALLIS SEWAGE DISPOSAL PLANT.

Longitudinal section and plan, showing septic tank and anaerobic filter.

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ficulties with the beds is that their capacity decreases rapidly by the filling up of the interstices of the material by a vegetable growth, thus reducing the original capacity as much as 4 per cent. in two years. It is found, too, that they require more skilled care than was at first anticipated, and, further, that the filtering medium must be removed and cleaned if worked at maximum rates.

The form of filters most popular at the present time is open percolating filters built upon a hard floor well drained; they vary from 4 to 8 feet in depth and are composed of any hard material that will not disintegrate by the action of the air and water. In experiments made with coke, coal, broken brick, cinder and broken stone, coal gave best results, and from many tests as to the best size, that broken to pieces varying from ¼ to ½ inch gave much the best results.

There are many patented devices and appliances for distributing the sewage over the beds, and this feature is of great importance. Revolving arms are used in circular beds. Sprays and jets from perforated pipes give good results, but create much odor. A good septic effluent can, they say, be purified by one of these filters at rates of from 400 to 500 gallons per square yard per day.

My own experience and observation with contact beds though limited, is far from satisfactory, and I have given most attention to filters, principally sand filters, operated intermittently and automatically. Some six of these plants are now in successful operation.

An interesting plant was built for the Allis-Chalmbers Company, at their new works in West Allis. Early in 1902, the company advertised for propositions for constructing a sewage purification plant with a capacity sufficient to purify the sewage from factories where 3,500 men were to be employed. The requirements so far as purification was concerned, stipulated that the "effluent from the plant shall be without odor and in such condition that no further purification shall occur. In particular, the effluent water shall be at all times unobjectionable in flowing through the course of natural drainage into which it is discharged beyond the limits of the property of the company."

The writer submitted a proposition on plans similar to the one later constructed for the County of Milwaukee in which sand filters were to be used for final treatment. At the suggestion of their construction substituted therefor. The plant was designed for a capacity of 80,000 gallons of sewage per day. It consists of a septic tank provided with a grit chamber and an anaerobic filter connected with the tank and the final treatment through an open percolating filter. The plant was constructed on a hillside; the tank is built of concrete and covered with a gable roof resting on top of the concrete walls with a plank walk through its center supported by the rafters. The tank is divided by a central partition into two long tanks, each 10 feet by 58 feet with 7.5 feet depth of water or a total fluid capacity of 68,000 gallons. Controlling valves are placed at the openings leading to a bypass pipe which will enable the sewage to be discharged through the grit chambers into the outlet, or it may be discharged into the outlet after leaving either the septic tank or the anaerobic filter. These openings are all provided with coffin shear sewer valves with two additional ones in the bottom of the tanks to permit the sludge or contents of either the tank chambers to be discharged into the outlet.

Each compartment of the tank has a separate discharge opening into the anaerobic filter; these are provided with floating weirs similar in construction to those used by Messrs. Snow & Barbour in their plant at Mansfield, O. There is several feet fall between the level of the water in the septic tank and that in the anaerobic filter so that a certain amount of air is admitted at this point by two falls. The anaerobic filter is 21 feet wide by 33 feet long, being a continuation of the tank itself. It has a drain outlet into the main bypass or outlet pipe also supplied by a shear valve and an 8-inch concrete trap and wall at the entrance and where the sewage must pass down underneath this wall into the filter and pass upward through the filtering material and over a weir the full length of the chamber into a concrete trough, thence to the distributing siphons. This filter is composed of lines of 4-inch tile conduit pipe, laid upon a concrete floor; they are spaced 4 inches apart with opening at each section of several inches between pieces. The entire floor is covered in this way, the end of the tile projecting through beneath the trap wall; on top of this tile are placed large pieces of coal clinkers so laid by hand that the finer material cannot get down to clog the drains. On top of these large pieces is placed 30 inches of coarse hard clinkers

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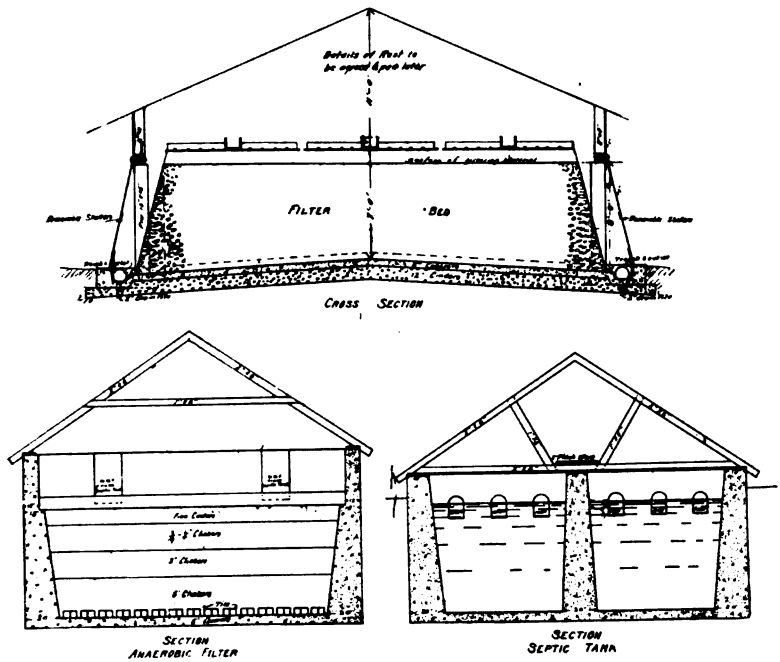
on top of this is 6 inches of a still finer grade of the same material, leaving a 6-inch depth of water over the entire surface when it is flooded.

A bypass is provided through which the effluent from the septic tank can be carried around this anaerobic filter and into the distributing chambers.

At the outlet end of the building and at the end of the anaerobic filter are three concrete siphon chambers each 3 by 5 feet into which the effluent passes when leaving the anaerobic filter; each chamber is supplied with a 12-inch wide weir notch in the edge of the side trough that receives the flow, distributing it equally to the three chambers. These chambers are supplied with 6-inch automatic siphons which discharge the contents of the aerobic filter and work independent of each other.

The object of the anaerobic filter is to produce conditions under which the facultative bacteria can do their work and prepare the effluent for more rapid nitrification in the aerobic filter.

The aerobic filter is an open filter constructed on a concrete floor or foundation; this floor is 40 by 60 feet in dimensions and has a slope of 6 inches from the center to the outside. Along the outside are concrete gutters which collect the effluent and discharge it through tile pipe into an open ditch below the works. On top of the floor are placed parallel lines of 4-inch conduit pipe sloping from the center to the sides for the purpose of admitting air to the interior of the filter. These tile are laid a few inches apart over the entire surface and on top of these is placed the filtering material which in this case is composed of coal cinders and clinkers varying in size from ¾ to ¼ inch in diameter. The outside was built of large clinkers laid carefully with a slight batter. The filter has a hight of 8 feet at the sides and 7½ feet in the center and a top area of 30x54 feet. Across the top of this filter is placed the distributing system, which is composed of three parallel lines of plank troughs constructed of 2-inch pine plank, making a trough 12 inches wide by 10 inches high. Into each of these troughs an 8-inch iron pipe leading from the siphons is connected in such a manner that each siphon feeds one-third of the bed. Across and at right angles to these troughs and spaced 3 feet centers are feed troughs. These are of lumber and are 9 feet long, projecting 4 feet on each side of the main trough. They are built of 12-inch



WEST ALLIS SEWAGE DISPOSAL PLANT. CROSS SECTIONS.

Anaerobic filter bed. Aerobic filter bed. Septic tank.

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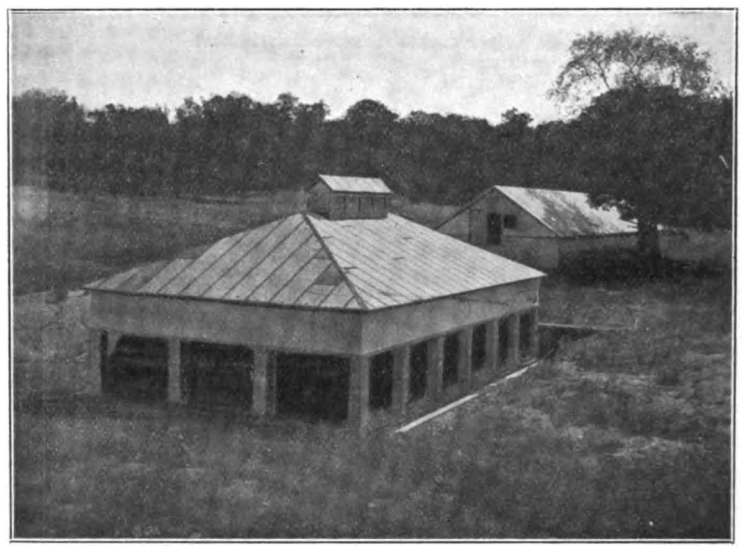
wide boards 9 feet long resting upon a wall of clinkers and elevated some 12 inches above the top of the bed. These walls were built of selected pieces, are wide at the bottom and narrowed to 16 inches at the top. On these walls are placed the bottom boards of the distributing troughs; these troughs are 4 inches wide and 5 inches high; they were constructed by taking a 4x1 inch strip of dressed lumber with two side pieces 8 inches wide nailed to its edges; then at a distance of 8 inches apart, notches ¼ inch wide were cut through the lower two inches of the sides and half way through the bottom. These boxes were nailed to the 12-inch board and the ends closed; they were then fastened with



WEST ALLIS SEPTIC TANK AND SEWAGE FILTER.
Aerobic bed in front, septic tank and anaerobic bed in rear.

cleats to the sides of the main trough, in each side of which is a 2 by 2-inch opening through which the water discharges into the feed troughs; these openings are provided with hand slides so that the amount of water can be regulated in order to get a uniform distribution over the entire area fed by one main trough.

The filter is protected by a wooden roof supported on brick piers and above the top of the filter it is closed in, while below the sides and the ends of the filter

no experience with this class of filter was available to determine the effect of extreme cold weather upon it.

The plant was constructed very carefully and was put into operation about Feb. 1, 1903, and has operated continuously up to the present time, and during this time it has given entire satisfaction. The final effluent is bright, clear and without odor.

The operation of this plant has developed the following facts:

1. That our estimate of 80,000 gallons per day was far too small, as the actual flow ranges during at least twelve hours of the twenty-four from a rate of 250,000 to 400,000 gallons per day, the average probably being 320,000 gallons, and contains a large amount of oil and hot water from engine and machinery.

2. That ordinary coal cinders, when carefully screened, will disintegrate under conditions here found, indicating that a harder material should be used for constructing filters.

3. That the outside of such filters should be constructed of square open tile laid in mortar or dry rubble masonry instead of the large clinkers, which disintegrate under action of the water and allow slides to take place.

4. That there is not so much danger from freezing in extreme cold weather as might naturally be expected; consequently the covering might be omitted en-

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good septic tank effluent a filter of this kind may be depended upon for a capacity of from 750 to 1,000 gallons of effluent per sq. yard of surface.

This filter has during the past six months, been operated continuously at a rate of at least 1,000 gallons per sq. yard during twelve hours each day and as at least part of the plant is operated during the night, it gets but little rest during that period. I have no knowledge of the night flow.

Since the plant has been operating several changes have been made. The aerobic filter has been surrounded with a brick wall laid dry, and the distributing system has been suspended from trusses resting upon brick piers and is now supported independent of the filtering medium and some fifteen inches above it. The system, however, proves very satisfactory and the distribution is even throughout the whole surface. The notches in the bottom of the troughs fill up with fine cinders washed from the anaerobic bed and a fungus growth, which requires that the slots be raked open once each week.

Temperature readings taken at different points through this plant during cold weather indicate very slight changes in the water. A typical set of readings indicate the following: Outside atmosphere, -13. Atmosphere inside septic tank with door open, 24. Atmosphere over filter bed with winter shutters in place, 44. Sewage entering plant, 60. Water leaving septic tank, 60. Water in siphon chambers, 54. Final effluent below the plant, 52. with outside atmosphere, 22. Readings show a loss of but 2 degrees in passing the entire plant, and in this, as well as a number of other readings, the water in leaving the septic tank is 1 degree higher than when it entered.

ROADS AND PAVEMENTS

The Bitulithic Pavement—Indiana Gravel Roads—Delays of Contract—Bitulithic Pavement Injunction—School Property not assessable.

The Bitulithic Pavement.*

By W. A. Hoyt.

A thorough exposition of the bitulithic pavement is not attempted in this paper. I therefore give some observations and conclusions which I have gathered in superintending the construction of about 55,000 square yards of this pavement during the past summer for the cities of Kalamazoo and Manistee, Mich., in a short correspondence with others who have had a similar or a greater opportunity for observation and in a study of available literature upon the subject.

I wish to say at the outset that I am not interested in the promotion of any kind of pavement whatsoever, except the one, which by merit alone, proves its right to promotion. The purpose of the paper is to bring out weak points as well as strong ones. If I err in my judgments it is because of the lack of acumen and not because of the lack of spirit of inquiry.

The legitimate predecessor of the bitulithic pavement, and with which the public so naturally confuses it, is the coal tar pavement. The history of this pavement is very erratic, with peculiar successes and disastrous failures. Tar macadam pavements were used in Paris in 1854 and they have been used in other European countries for many years. They began to be used in this country about 1866. Mr. Tillson, in his "Pavements and Paving Materials," speaks of a few of these pavements in Brooklyn and elsewhere, which have lasted for over twenty years. The experience of Washington, D. C., affords the best opportunity for the study of coal tar pavements. From 1871 to 1888 there was laid 864,400 sq. yds. of this pavement, all essentially the same, in the use of the broken stone base coated with tar, a wearing surface, of varying thickness and composition, depending upon the patent under which it was constructed. In all the pavements coal tar was used either crude or partly refined, and either alone or mixed with sawdust, sulphur, sulphuric acid, slacked lime or asphalt, or a combination of several of these materials. Of these pavements something like 20 per cent. of the total yardage failed in two or three years, about 50 per cent. in seven years, and 91 per cent. in 15 years. While 4.9 per cent. lasted for 26 years and 1.2 for 30 years. The average annual cost for repairing those streets which have

*From a paper before the Michigan Engineering Society.

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lasted for thirty years and over, is very low—about 2.2 cents per sq. yd. The method of construction was very crude. At first the tar and stone were mixed cold and later were mixed hot, the stone was heated on a drying floor and the tar in kettles, and mixed with shovels as concrete. Still later, when mechanical mixers were used, there was no uniformity in the tar or attempted gradation of the stone. Mr. A. W. Dow, Government Inspector of Asphalts and Cements, says that in all pavements of "this class which lasted well, no material except refined coal tar was used as the cementing agent, with, in some instances, the addition of a little asphalt; and those pavements in existence today were all laid with straight refined coal tar." He further says that the long life of these old pavements "can only be looked upon as a lucky accident," and for this reason "it is a remarkable illustration of what coal tar bitumen can do by chance."

Despite these failures, coal tar pavements continue to be used and in the last few years have become quite popular in Canada. Some of the places repeated the same mistakes as were made at Washington. Hamilton and Toronto have been using it in increasing amounts for several years. These pavements appear to give satisfaction in many cases and cost from 40 cents to $1.25 per square yard.

The unusual wearing qualities of some of these old pavements attracted the attention of men interested in the paving business. While at the same time the conditions of the asphalt trade, and some difficult features connected with that construction, caused men to seek for some other form of pavement.

Mr. S. Whinery, M. Am. Soc. C. E., for several years in the asphalt paving business, advocated in 1901 an asphalt macadam pavement which would combine the low cost and non-slippery features of the macadam with the smooth hard surface, noiselessness and sanitary features of the asphalt pavement. Thus he thought to obtain a pavement which would not be dusty and "ravel" as macadam, and would not be slippery and crack and shift and "scale" as asphalt. He considered the combination more durable than asphalt pavement based on the same general line of reasoning. He had made a study of the old coal tar pavement and proposed to use a coal tar pitch for the binder and a graded stone for the metal.

Method of Construction.—The subgrade and foundation will not be taken up in detail, as the work is nearly identical with that of the macadam pavement, with which all are familiar, except only, to mention a matter which caused great consternation amongst the "curbstone engineers." The sand came through the stone so badly that we began the use of a light sprinkling of coarse hay upon the subgrade. This hay, in large quantities would help the rolling of the subgrade, and a light layer being left, it kept the sand down considerably. It was not permitted in bunches or upon questionably spongy soil.

Usually a six-inch macadam base is used, the stone varying in size from that which will pass a three-inch ring to that held on a one-inch ring. This should be thoroughly rolled so as not to ridge or shift under a fifteen ton roller. If necessary to bind the stone, a light coat of smaller sizes should be used. Smooth places caused by the concentration of fine stone and dust are not desirable. If sand, mud or clay works up through it should be cut out, replaced with stone and rolled until solid. When the rolling is finished the surface should have a uniform grade, the thickness of the wearing coat below finished grade, over the entire surface. This point should be watched and a variation of one half inch should be the maximum. The spreader in charge of forming the surface should have two eyes and a judgment and know how to use them.

Upon this foundation is spread a light sprinkling of what is called Warren's No. 1 Puritan Brand Semi-Liquid Bituminous Cement. Upon this is then uniformly spread a coating of No. 24 bituminous cement. To coat the stone entirely it requires about one gallon per sq. yd., which amount is stipulated in the specifications.

The wearing surface is ordinarily two inches thick after compression; it is composed of granite or hard field stone, varying in size from 1¾ inches to an impalpable powder, with stone dust or hydraulic

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hauled to the street. When this is shoveled from the platform, upon which it is dumped, and spread upon the street, it should not be thrown, but deposited where wanted as concrete. Much depends upon the rakers who spread the material after it is deposited in place by the shovelers, to keep uniformity in the mixture and to get a uniform surface by filling up irregularities left in the foundation or caused by subsequent settlement in rolling the surface. The rolling should follow closely upon the spreading of the material.

Upon this wearing surface is then spread a thin flush coat of bituminous cement, just sufficient and no more, to fill all honey comb which may exist. The amount required varies with the irregularities of the surface and the amount of the rolling it gets before cooling. Too much, especially in cold weather, is worse than not enough. Over this is spread a light coat of stone chips of a size depending upon the roughness of surface desired, and rolled in. These successive layers should follow sufficiently close upon each other to allow the surface to receive its full amount of rolling before it becomes cold. This time will vary greatly depending upon the conditions of the weather. Much depends upon the rolling to make the surface dense by wedging the stone together and by forcing out air bubbles. The first rolling of the wearing surface should be lengthwise of the street, but it should be gone over diagonally before the rolling is finished. The weight of the roller should not be less than fifteen tons, with a 20-in. rear wheel which gives a compression of 450 lbs. per in. width of wheel. Loads of 1,000 lbs. are frequent and they sometimes run up to twice that amount.

All the bituminous material from the first that is applied to the last sprinkling of stone chips should be heated, and all, except the No. 1 bituminous composition, should be applied to the street at between 200 degrees and 250 degrees F., but none, not even the stone chips, should be heated over 275 degrees F.

Each layer should be kept free from dirt and moistnre. It is best to suspend work during wet weather, and to stop work when the thermometer reaches 25 or 30 degrees F.

Difficulties encountered in the foundation work are those common to macadam pavements. Sand and mud must not be permitted to fill the voids in the foundation stone. The only real difficulty that I experienced, and I find the same difficulty with others, was in getting a uniform surface. If the crown is low (less than 5 inches for a 30 foot street or 6 inches for a 40 foot street) or the grades are flat (less than 0.33 per cent.) great care must be taken to avoid small pools of water and to make the gutters drain. Under the repeated rolling, slight settlements may take place. An apparently solid subgrade may get wet and "churn up and make the surface spongy and uneven, which may necessitate cutting out the pavement or burning down and building up the surface. Slightly spongy spots tighten up after a few days and appear to be satisfactory. Small depressions should be kept less than ⅜ of an inch under a four-foot straight edge and long swells, aside from the gutters, within ½ of an inch from established grade.

Stone for the base is selected on the same principle as for macadam. It should be sound, hard stone, not friable under the roller. The scare, which some would-be wise heads sometimes succeed in creating about limestone disintegrating in the foundation is entirely unfounded. The effect of frost upon a porous stone in the foundation would be extremely small, as there is ample room for drainage and expansion. Of course, it is better to have a hard stone, so it will last for several resurfacings.

The wearing surface must have three chief properties, which have long been recognized as essential to a good road material. They are hardness, or "the resistance which a material offers to the displacement of its particles by friction"; toughness, or "the power possessed by a material to resist fracture under impact," and cementing or binding power. The latter property is furnished by the bitumen, therefore a harder and tougher stone, not suited to a macadam pavement, can be used. A hard, tough granite or field stone fulfilling the above conditions is essential—limestones are not suitable.

The Bituminous Cement used must furnish this cementing or binding power. According to the specifications furnished by the patentee of this pavement, the bitumen or pitch shall be free from water, petroleum oil, naphthalene, and other crystalline matter, susceptible to atmospheric influences.

As this pitch is surrounded with so much mystery, and is the chief point of attack, an attempt was made to get some definite information upon the subject. Expert chemists were unwilling to

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commit themselves, and any general information was hard to find. It is, however, manufactured from coal tar by a process of distillation, unknown to the public. (The paper gave a rather lengthy technical discussion of coal tar and its manufacture.)

A coal tar pitch, in its normal conditions is a bright, black, lustrous substance, sometimes with a grayish tint, and breaking with a conchoidal fracture. Some English requirements of the pitch of commerce are, that the sample must "twist fairly after an immersion for two minutes in water at 140 degrees F., but not under 120 degrees," and must contain at least 53 per cent. of "volatile organic matter."

Mr. A. W. Dow of Washington, who is undoubtedly the best authority in the United States, recommends the following tests:

The ductility and fluidity are determined by ascertaining the distance at which a piece of the cement may be drawn out before breaking, at temperatures of 20 degrees and 70 degrees F. The one that is the most ductile is the most perfect fluid and is therefore the best.

The rate of softening is determined by finding its consistency at 32, 77, 100 and 115 degrees F.

The heat effect, in the manufacture of the pavement, is determined by taking a sample of known consistency at 77 degrees F., and raising it to 300 degrees F. for eight hours, then finding the consistency at 77 degrees F.

Aging is brought about in two ways, that is, by surface hardening and body hardening. The first is due to the oxidation and volatilization of light oils. The second is apparently due to condensation of molecules. The aging is determined by taking a sample, exposing it to air away from dust and finding its consistency at 77 degrees F. at different periods, until the sample appears to have hardened, then a long slanting cut is made through the sample, and penetration is ency is determined by the penetration of a certain sized wire under a definite load.

As cements are not of the same degree of purity, it is necessary for comparison to make these tests on a basis of the pure bitumen. After a relation between these physical tests and the bitumen has been established, tests can be made on a new cement and an allowance made for impurities. Chemical tests are, therefore, necessary for this comparison and also because upon the amount of bitumen depends the cementing power of the mixture.

The foundation of this pavement is patterned after that of the old tar macadam pavements, which proved to be so very durable. Some recommend a concrete base, with the surface laid directly upon it, and others a concrete base with three or four inches of stone upon the concrete. The first does not obviate any of the difficulties of the sheet asphalt, and the latter would appear unnecessarily expensive. I am of the opinion that a broken stone base, thoroughly rolled and compacted is the best. It gives ample drainage, and more body to the pavement, as the wearing surface and base are monolithic. It will not be so easily resurfaced, but this is not of great importance. I think the claim made by some of the promoters, that the stone are rolled with a heavy roller, while the concrete is only tamped in place; and therefore, the stone is better, is not a good one. The stone base makes the pavement more elastic in its application. For in many places, where stone are dear, other material could be used, and in other places where travel is light and there is a well-compacted gravel roadway, a base of three inches of stone would appear sufficient. Thus by paying more attention to the subgrade the base could be made to suit local conditions. When the surface becomes worn, care should be taken to prevent water soaking through to the foundation. If there is not adequate supervision of the backfilling of the trenches cut through

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trated loads will not shear or shift the material.

2. It must have cohesion, so as not to easily grind up or wear out under travel

3. It must be elastic to allow for expansion and contraction.

4. It must have a sufficient range of flexibility, so as not to become sticky or shift in summer or to crumble and crack in winter.

5. It must be impervious to water.

6. It must not disintegrate under water.

7. And it must contain the foregoing properties sufficiently long to allow a nearly even and uniform wear of the pavement.

The question whether asphalt or coal tar pitch would best fulfill these requirements is a question for the specialist. The fact that the patent under which the bitulithic pavement is laid, permits the use of "coal tar, coal tar pitch, asphalt, or a mixture of them or other equivalent bituminous material," together with the fact that asphalt is cheaper than the pitch, would indicate that the manufacturers of the pavement have more confidence in the coal tar distillate.

Municipal Engineering assigns values to the bitulithic pavement as follows:

	Ideal.	Bitulithic.	Asphalt.	Brick.
Tillson's table ...100		82	76	67
Baker's table ...100		88	77	70

These values could be altered slightly perhaps, but in general, as far as I am able to determine, they appear correct. It is of course understood that these ratios are not absolute, but that they must vary to suit local conditions, and these local conditions should be studied with the knowledge of the advantages possessed by various paving material to suit different conditions.

The above requirements from one to six inclusive, have already received a thorough test in actual practice. More time is yet required to demonstrate the seventh condition. The sixth, an important factor, is fully secured in the coal tar pitch; as it appears to be a well-known fact of chemistry that "it is wholly insoluble in water." And because it has this property it will be less pervious to water. But the lower temperatures of manufacture of the bitumen would perhaps give it more volatile matter and thus counteract the above effect.

The claim that the gradation in the sizes of stone gives the metal aggregate inherent stability, and thus permits the use of a softer and therefore more durable bitumen, is unquestionably a good one. The softer bitumen would give greater adhesion, cohesion, elasticity and range of flexibility than a hard one. This gradation in the stone, reducing the voids to 10 or 12 per cent., gives much less area of stone to be coated, therefore less of the surface of cement exposed, than with the sand mixture. And if the same amount of pitch were used, which I see no reason for doing, the film of pitch would be much thicker around the stone and therefore better. It appears to be true of asphalt pavements that those with well graded sand are more durable. And also that the softer the bitumen used the better the pavement.

If any city wishes to do its own work arrangements can be made with the Bitulithic Paving Company to furnish the patent pitch at a cost of $1 per square yard. This includes the expert advice necessary in its use and in proportioning the mixtures. The cost of doing the work would depend upon a great many things, such as: The proximity of suitable stone, in mass or crushed; the amount of work to be done, and local labor facilities. The class of labor required is higher than that required for macadam pavements. The cost of labor per sq. yd. on the street and at the plant, for mixing surface material, exclusive of hauling and excavating, is about 12 or 13 cents. Thus if the stone costs 38 cents per sq. yd. on the street for an eight-inch pavement, the total cost exclusive of plant and tools would be about 50 cents per sq. yd. This does not take into account delays from bad weather or breakdowns or cost and deterioration of tools and plant.

In conclusion I wish to say that I began my correspondence with different cities, with the expectation of finding some dissatisfaction with the pavement; but there appears to be general, and in many cases enthusiastic, approval. Conservatism is a commendable attribute, but when a method of construction receives such universal approval from practice and profession alike, conservatism must give way to commendation.

New Gravel Road for Clinton County, Indiana.

A number of farmers of Clinton County, Indiana, who recently petitioned for new gravel roads, appeared before the Board of County Commissioners Jan. 4 at Frankfort and asked for permission to

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withdraw their names, claiming that the expense would be too heavy and that their taxes would be increased more than they had counted upon. The board of commissioners ruled, however, that the matter had gone too far to be stopped now and the roads will be constructed.

Pittsburg Not Liable to Contractor for Delays.

An opinion handed down by Judge R. S. Frazer at Pittsburg, Pa., Jan. 18, holding that the city of Pittsburg is not liable to Werneberg, Sheehan & Co. in the sum of $134,727.64 on the Grant boulevard contract. The above firm brought suit against the city for $384,944.07 on the contract for the paving of the street, claiming the amount to be on the final estimate and for extras ordered. Most of the items were based upon an alleged failure of Director E. M. Bigelow of the department of public works to procure the necessary rights of way for the boulevard, thereby preventing the contractors from completing their work in the time specified by the contract. The lower court rendered a verdict for the plaintiffs in the sum of $134,727.64 with a question of law reserved as to the right of the contractors to recover anything. Judge Frazer's decision was rendered on a motion for a new trial by the plaintiff and a motion by the city for judgment in its favor, notwithstanding the verdict.

New York Paving Injunction Granted.

The appellate division of the New York Supreme Court handed down a decision January 22 reversing an order of the special term denying a motion for a temporary injunction asked for by the Barber Asphalt Paving Company against William R. Wilcox, John E. Eustis, and Richard Young, as commissioners of parks. The proceeding was a taxpayers' action to enjoin an alleged illegal award of a contract for furnishing and setting new curbstones and paving with Warren Brothers' bitulithic pavement. The commissioners advertised for bids and with such definiteness and precision as to prevent competition. The specifications should be of a more general nature. In the present case the plaintiff alleges, and it is not denied, that the defendants intended to accept the proposal for the patent pavement. The law does not forbid the use of a patented pavement, but it does prohibit the award of a contract unless the proposals are invited under circumstances which afford a fair and reasonable opportunity for competition. The order is reversed, with $10 costs and disbursements, and motion for injunction granted, with $10 costs.

Pennsylvania School Property Not Assessable for Improvements.

A decision was rendered by Judge Kelly Jan. 19 in the suit of the City of Scranton, Pa., aganist the school district of that city. The city sought to ascertain whether or not it can collect sewer assessments from the school district for sewers constructed in front of the schools. The opinion, which is in favor of the defendant, is as follows:

The only question in this case is whether the real estate of a school district used for school purposes is liable to assessfent for school purposes is liable to assessment front of it. This question has been so recently decided by the Supreme Court that a discussion of it would be idle. Mr. Justice Mestrezat, in a very exhaustive opinion, in Pittsburg vs. Sub-District School, 204 Pa., 635, has covered the whole question, and in that case the point is decided in favor of the school district. After a review of the authorities Mr. Justice Mestrezat says: "These authorities conclusively show that statutes imposing assessments for local improvements are enacted in the exercise of the taxing power of the legislature. They, therefore, notwithstanding the generality of the enumeration of the property affected, do not apply or relate to property held or used for public purposes by the state or any of its political subdivisions. The reasons given for this rule given in the au-

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relieves the public from the necessity of contributing to the cost or expense of the improvement. If public property purchased by funds raised by taxation is subjected to assessment, it is the public paying the public, which clearly discloses the absurdity of the proposition." Further comment is unnecesary.

WATER, LIGHT AND HEAT

Steam Heating from Central Station—Regulations for Electric Wires—Toledo Water Consumption—Electrolysis in Richmond—Electric Shock from Fire Stream.

Steam Heating from a Central Station.*

By F. B. Hofft.

Heating from central station approaches very nearly the ideal. It is clean, even, pleasant and sanitary; little if any more expensive than the individual plant, and with none of its difficulties. It is undoubtedly the best known cure for the smoke nuisance outside of manufacturing districts. It has so many advantages and with practically no trouble or care to the consumer, that its success, when installed and operated properly, has been instantaneous and complete.

Central station heating is the result of the outcome of several conditions of prime causes; namely the demand of the public, following, particularly in this state, failure of the natural gas, the uncertainty of the coal supply, and the just complaint of the public against the smoke nuisance. Second, and probably the more important cause is the endeavor of the manager of the local electric light and power company to increase the earning power of his plant; to get some revenue out of what might be called waste energy, namely, exhaust steam.

The time was when the manager was content, if his cost per kw. per hour compared favorably with the average of his class. The price per ton of his coal, together with his revenue, and not the small percentage of heat units delivered at the switch board, was the criterion by which he judged of his economical operation.

And even in this day of the high efficiency engine, generators, boilers, stokers, etc., when we are approaching the limits of efficiency we are only turning into revenue earning energy about 7 per cent. of the coal shoveled on the grates To this 93 per cent. loss and how to decrease it, or turn it into a source of revenue, have been given the best thought and endeavor of the up-to-date manager and engineer, and he has found in the heating plant a practical method of redeeming a large portion of this waste.

Central Station heating may be divided into two clasess—hot water and steam; steam may then be divided into two classes, first the straight heating plant, both high and low pressure; second the low pressure or exhaust steam plant. This latter class may again be divided into two classes, namely the return system, or where the condensation is returned to the power house, and the one-pipe system where the condensation, after being cooled, is discharged into the sewer and is a loss.

This paper will be confined to the latter class, and more particularly to the plant of the Merchants' Heat and Light Company of Indianapolis, together, with its operation.

A brief history of the plant would read as follows: Simultaneously with the failure of natural gas, the uncertainty of the coal supply, together with smoke and the inconvenience of the individual plant, and a demand for cheaper electric light, a movement was set on foot by the Merchants' Association of Indianapolis, looking to the overcoming of these and many other difficulties, and the logical solution was central station heat.

Mr. W. H. Schott, who later designed and installed the plant, was called in, plans and estimates were furnished and active steps taken toward getting things started. A franchise, covering the business section of the city for steam heating

*A paper read before the Indiana Engineering Society.

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and electric light was secured on July 29, 1902, and by the following January steam was being carried through a long system of mains and several buildings were being heated. Since then to the present day, or practically one year, the plant has given entire satisfaction, which is confirmed by the fact that about one hundred and twenty-five of the largest business buildings, making a total of nearly 200,000 square feet of steam radiation, are being supplied by exhaust steam.

The following short description of the plant will give a fair idea of its make-up. The plant was designed to run condensing or straight electric during summer months, and with a back pressure of from one to seven pounds during the heating season. The capacity of the power house at present it but one-third of its ultimate size. It is equipped with seven 250 hp. Wickes water tube boilers, with Roney stokers designed for the burning of slack coal. In the engine room are three 500 hp. and one 350 hp. Ideal compound engines, designed to run condensing on 18 pounds of steam per hp. per hour and 27 pounds of steam when running with a back pressure of five pounds. The engines are directly connected with three 350 kw. and one 250 kw. Western Electric direct current 250 volt generators, two 1,000 ampere compensators, one 2,000 hp. Cochrane-Sorge heater and purifier and one 2000 hp. Worthington jet condenser and cooling tower complete. A twenty-inch Davis back pressure valve is installed on the open air exhaust. There is also a ten-inch live steam line connected to the heating main through an automatic reducing valve to furnish live steam if there should be an insufficient exhaust to maintain the required heating pressure.

The system of street mains was laid out to supply 500,000 square feet of radiation with a power-house pressure of five pounds; and at present there are installed 16,885 feet of mains, varying in size from eight-inch to twenty-inch pipe. The greatest distance this exhaust steam is carried is 4,840 feet, and at this point there is a building requiring 7,500 square feet of radiation. The most of the underground insulation was special design and built up of two-inch hemlock lumber, set staggered, with two dead air cells between the layers of lumber, filled with a special hair felt. The space between the pipe and the insulation is filled with soft-wood placed about 150 feet apart in man-holes, pipe resting on rollers, giving free travel; services are taken off from up-turned tees and given considerable swing to allow slight travel of the main. Service connections are not made within thirty feet of an expansion joint. Anchors are placed about midway between expansion joints, thus giving a maximum travel of any service connection of about six-tenths of an inch. Line condensation is collected at the low points and discharged through traps into dry-wells.

Connection to the building is made to a suitable point in the consumer's system. A trap is set on the return and condensation sent through what is called a cooling coil, which is water radiation set to heat the basement, or boxed up and used as indirect radiation on first floor through a floor register. From the soiling cell or water radiation the water is discharged into the sewer at about 150 degrees. In many instances this condensation is used to heat water for domestic purposes by means of a range boiler

Probably the most important feature of the entire system, from a satisfactory and economical operating standpoint, is the automatic building temperature regulation. Its value as a steam saver can be placed at 40 per cent., while its value considering the even temperature, can hardly be estimated. Without temperature regulation, central station heating would not be the success it is today. Regulation on this system is obtained by means of thermostatic control of a regulating valve on the steam supply. This is operated by compressed air from the power house of fifteen pounds pressure. The valve is sneak feed and gives a regulation not varying over two degrees. A small valved by-pass is connected around the regulator and the valve slightly cracked. This keeps the main warm during such time as the regulator is entirely closed for a considerable period, and prevents the regulator opening into a cold main keeps the air out of the main and gives a more rapid circulation of steam.

Let us now consider the operation of the plant under heating conditions. Since it is exhaust steam that is used we will consider the heating as a by-product of the electric light plant. To do this we must charge up to lighting only that portion of the operating expenses required under the best operating conditions, i. e.,

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costs of each, leaving out the factors that remain constant.

Let us assume an electric load of 750 kw. as average for twenty-four hours, and consider the plant first as a straight electric light plant. As above mentioned the engines are to be run on eighteen pounds of steam per hp. hour. This will make a total of 432,000 pounds of steam during the twenty-four hours. The running of the condenser pumps consumes say 40 hp. at eighty pounds of steam per hp. hour, making a total of 67,200 pounds. The running of the cooling tower fan, say twenty hp. electric motor, would take in steam value about twenty-one pounds per hp. hour, a total of 10,080 pounds of steam. The boiler feed pumps will average about fifteen hp. at eighty pounds of steam per hp. hour, a total of 28,000 pounds. Thus we have an approximate value of steam consumption for twenty-four hours running as condensing plant, 538,080 pounds of steam.

Now let us change the conditions to heating. The average outside temperature for the city of Indianapolis for the seven heating months is 29 degrees. With this outside temperature, and 200,000 square feet of radiation connected, the power house pressure required will be three and one-half pounds. This would mean a back pressure on the engines of three and one-half pounds, and the steam consumption would increase from eighteen pounds to twenty-six pounds per hp, hour. Going back to our electric load of 750 kw. under these conditions we will have an engine consumption for the twenty-four hours of 624,000 pounds of steam. The boiler feed pumps will increase to say twenty hp. at eighty pounds, a total of 33,600. The deep well pump will increase due to the loss of condensation, about five hp. This is driven by electric motor, and placing its steam value at twenty-one pounds per hp. hour it will require 2,520 pounds of steam. Adding this up we will get a total of 661,120 pounds of steam. This will, together with its condensation, take care of 183,000 square feet of radiation. Since we are figuring on 200,000 square feet, there will be live steam required for 17,000, or about 69,600 pounds of live steam. We thus, have a total steam consumption, when operating heating and lighting, of 729,720 pounds of steam.

There are other conditions entering, which must be balanced in heat units, for example, when operating under heating conditions the boiler feed must be heated from the well temperature to 210 degrees. The raising in temperature of 729,720 pounds of water from say 50 to 210 degrees will require about 117,155,200 heat units. Now to balance this feed water heating charge, we will charge aganist the electric light plant the heat units required to raise the water from a hot well temperature of 90 degrees to 210 degrees, This would be 538,000 pounds of water, 120 degrees, or 64,569,600 B. T. U. or difference to be charged against the heating department of 52,585,600 B. T. U. Reducing this to steam at 150 pounds pressure, since no deduction was made from the steam available for heating, and charging it aganist the heating department we have 40,000 pounds of steam.

From the above figures we get, from the condition assumed, a total steam consumption, when running as a straight electric plant, 538,080 pounds of steam and a total consumption of steam when running as both electric and heating, of 729,720, plus 40,000 equal to 769,720, or a difference in steam consumption of 271,640 pounds of steam for the twenty-four hours.

This 271,640 pounds of steam, which is about one third of the total steam consumption, together with the additional labor represents the cost of operation treating the heating as a by-product of the electric light plant.

Construction and Maintenance of Electric Wires.

The following regulations for the use and maintenance of electric wires were given in a paper by A. S. Hatch of the Detroit Electric Light Commission before the American Society of Municipal Improvements:

Wires are divided into two classes.

1. Those for telegraph, telephone and signalling purposes.
2. Those for electric light and power purposes.

These are classified as overhead and underground.

1. Two pole lines bearing the same class of wires shall not be erected in the same street, avenue or alley, nor shall two pole lines of either class be erected on the same side of any street, avenue or alley. Whenever possible, all pole lines shall be built in alleys.

2. Poles shall be set near to and within the curb and not nearer than ten feet from any hydrant. They must be at least five feet in the ground for a thirty foot pole, and not less than one-seventh of their length for longer poles. Where pole lines intersect, there must be a

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pole used in common, when so required, unless otherwise specified in the permit.

3. All poles now standing, or hereafter erected, shall be branded or stamped with the name or initials of the company owning them. Each group of cross arms, or where necessary the support of a single wire of different ownership must be distinguished by some characteristic mark or fastening, otherwise the owner of the pole will be held responsible.

4. All poles erected in conspicious places must be of such weight and dimensions and be painted such a color as may be approved by the Public Lighting Commission.

5. Each line of poles must run on one side of the street only unless special permission is given to cross.

6. Cross arms must be at least twenty-four inches apart, strengthened by braces and designated by some characteristic mark if belonging to a company other than the one owning the poles. In class 1, pins must be at least twelve inches apart and inside pins twenty-eight inches; in class 2, inside pins thirty inches, all others fourteen inches. Where wires under class 2 are taken from the main line at any angle, the outside pins must be steel or cored, or an iron guard placed between the outside pin and the end of the arm.

7. All wires must be fastened upon poles or other fixtures with glass, porcelain or other insulators approved by the commission, stretched properly and fastened with a tie of the same kind of wire or other fastening approved by the commission. Lines of wires at intersections must not pass through each other, but must be either above or below, preferably class 2 above that of class 1. Upon all poles the lowest point in the wires suspended from them shall not be less than twenty-five feet from the ground.

All wires which would naturally pass within four inches of any pole, building or other object must be attached to the same and insulated therefrom. All wires strung on house tops must be at least seven feet from flat and one foot from the ridge of pitched roofs. The permit

proportion to the strain and not smaller than No. 8 Birmingham wire gauge and all angles must be guyed, the guys insulated, and where there are more than four wires in the line, head guys must be used.

10. Every line, pole or fixture must be kept in thorough order and repair, in conformity with these rules and regulations in every case, where possible, under the general permit for repairs (rule 16), upon penalty of forfeiture of all permits not acted upon and a refusal to grant new permits until the rule is complied with, but no additional poles or wires can be erected under cover of repairs nor shall any route or location be changed without a permit.

11. All wires or current carying conductors, poles, guys or apparatus belonging to any person, firm or corporation that may be found dangerous to life or property or intruding on the rights of citizens or other corporations must be remedied by the owners thereof when notified. This applies to any damage to sewers, conduits, cables, gas or water-pipes by electrolysis or otherwise.

12. All wires of class 2 must be secured to insulating fastenings and covered with an insulation easily abraded and waterproof approved by the commission. Whenever the insulation becomes impaired it must be renewed immediately.

13. All connections with pole lines for service in either class must be made at right angles to the line where possible, and connections to buildings shall be run straight across to buildings, where possible, and then down and the insulation must be preserved throughout the entire circuit.

14. No electrical conductor shall be erected, maintained or placed overhead or underground without a permit in writing therefor being first obtained from the Public Lighting Commission, and before such permit is issued the person, corporation or company wishing to place or maintain said wires shall make application to said commission in writing stating the size of said wire, the purpose for

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ency repairs may be made without permit, but a report of such repairs is to be forwarded within twenty-four (24) hours after the making of the repairs and a regular permit taken out at that time.

16. Where notice has been given of underground accommodations and the notice of time required by law has elapsed, companies owning or operating overhead lines are not authorized to make any repairs or connections, or to go upon the poles bearing such wires for any purpose whatever except to remove said lines in conformity with the direction of said Commission.

17. The amount of wire allowed for service connection from a pole to a building shall not exceed 130 feet between supports, except by special permit.

18. The person, firm or corporation owning or controlling poles in any street, alley or public place in the City of Detroit must allow the same to be used by other persons, firms or corporations operating wires, cables or conductors for electrical service when authorized to do so by the Commission on tender of proper compensation to be determined by agreement between the parties interested. If the present capacity is not sufficient for both lines and unless otherwise agreed upon between them the party desiring accommodation may rebuild the line of poles and rent contracts to the owners of the previously existing lines at terms to be agreed upon between the parties. In default of any agreement between the parties interested, the matter may be referred to the Public Lighting Commission for arbitration and their decision is to be final.

19. Any person, firm or corporation in accepting any permit from the Public Lighting Commission hereby binds himself or themselves to the acceptance of any provisions specified in any rule established or to be established by the Commission, unless it is specifically excepted in the permit. The Public Lighting Commission reserves the right to alter or add to these rules as they may desire at any time.

20. It shall be the duty of the Public Lighting Commission to turn all money received under this ordinance into the Public Lighting fund of the City of Detroit.

21. No person, firm or corporation shall train wires, erect poles, build conduits, manholes, hand-holes or make any alterations whatever in electric line equipment without first notifying this Commission in writing giving a description with diagram of the proposed work, allowing ample opportunity for inspection, and receiving from said Commission a written permit to do the work described. All such work, equipment, alteration or addition shall be done under the supervision of and subject to the inspection of said Commission upon finding the work to be done according to such rules and regulations, the Commission shall certify and place the record thereof on its books, maps, cards or diagrams; but no such equipment shall be used by anyone until such certificate shall have been given by said Commission in conformity therewith.

22. Any firm or corporation who shall make contact to poles or other property of the Public Lighting Commission, Police or Fire Commissions without having obtained a permit for the same from the Public Lighting Commission shall pay a fine of three dollars for each such unauthorized contact and no further permits shall be granted to said person, firm or corporation until the aforesaid fine or fines are paid.

23. Owners of lines of poles or of buildings shall remove therefrom all dead wire or wires fastened thereto in violation of these rules, when notified to do so by the Public Lighting Commission within a reasonable time to be expressed in the notice; on failure to do so the Public Lighting Commission will proceed to remove the same.

Many details can be added to these rules, if necessary to fit local conditions.

Consumption of Water in Toledo, O

The annual report of E. D. Locke, chief engineer of water works at Toledo, O., shows that from April 1 to Dec. 31, 1903, 2,715,167,000 gallons of water was pumped, making an average of 9,873,335 gallons per day. During 1902 the pumpage for the same period was 2,493,707,710 gallons, an average of 10,068,829 gallons per day. The pumpage during the last nine months shows an increase therefore of 804,506 gallons per day.

Electrolysis in Richmond, Va.

The city water committee of Richmond, Va., has decided that the Passenger and Power Company must pay the city damages for injury to the city pipes by electrolysis before the city passes upon and approves a system that will be non-destructive. The company had its tracks bonded, but it is now feared that it will be compelled to install either a double

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wire or an underground system, which would cost in either case $250,000 to $300,000.

Electric Shock from A Fire Stream.

In a communication from L. W. Matthewson C. E., of Cincinnati, in which he refers to the article that appeared on page 54 of the January number of Municipal Engineering, entitled "Electric Shocks from Fire Streams," he sends a brief description of a fire that occurred at a distillery in that city Jan. 19. The water tower was run up to a position of advantage and the water turned on the flames, when suddenly a sheet of white flame shot out and spread itself from the edge of the pavement to the building and the tower. Capt. Charles Burk, who was working the nozzle, was hurled from his elevated position horizontally into the air and fell to the street. As the stream from the water tower nozzle shot out it crosed with all its force the electrically charged wires that interlaced the elevation in front of the burning building and produced the electrical phenomena observed.

CEMENT AND LIME

Cement Statistics—Cement and Lime Mortar—Cement at St. Louis Exposition.

Cement Statistics.

The report of the United States Geological Survey on the production of cement in the United States in 1902 was issued early in January. For 1901 and 1902 the totals are as follows, the exports being taken from Treasury Department reports:

	1901.	1902.
Natural cement, brls..	7,084,823	8,044,305
Portland cement, brls..	12,711,225	17,230,644
Puzzolan, brls.....	272,689	478,555
Total domestic prod'n..	20,068,737	25,753,504
Imports, brls..,.....	939,330	1,961,013
Exports and re-exports	419,819	375,130
Total net domestic consumption	20,588,248	27,339,387

The increases in items and the percentages of increase as derived from this table are as follows:

	Barrels.	Per Cent.
Increase in natural cement	959,482	13.5
Portland cement	4.519,419	35.6
Puzzolan	205,866	75.5
Domestic production	5,684,767	28.3

The effect of the labor troubles is considered in the editorial department.

The true state of the case is still more clearly indicated if the imports for the year ending June, 1903, are taken for comparison. The great increase in imports began in July and August, 1902, and continued for a little more than a year. The Treasury Department's fiscal year nearly covers this period and shows an importation of over 2,770,000 barrels of cement, or 50 per cent. more than is shown in the calendar year 1902. The overstocking due to the labor troubles then shut off importations which have again been small since the autumn of 1903. However, the imports for the year ending with November, 1903, were over 2,400,000 barrels.

The increase in production of Portland cement was distributed as follows New York, 540,000 barrels; Pennsylvania, 2,200,000 barrels; Michigan, 500,000 barrels; other sections to make up the balance.

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ginia (including Alabama and Georgia), each over 300,000; California (including Utah) and Illinois, from 150,000 to 250,000 each; while Colorado, Ohio and Texas show losses, the former of 500,000 and the others 125,000 and 30,000, respectively.

An interesting section of the report is the review of the industry in each state. Those wishing greater detail can find it in the study of the descriptions of cement plants in the "Directory of American Cement Industries," third edition, shortly to be issued.

Tests of Cement and Lime Mortar.

In Municipal Engineering, vol. xxiv, p. 217, were published some tests of mortar made of limoid and Nazareth Portland cement, showing the results at 7 and 28 days and 3 months age on briquettes. We now have results for a full year, and for purposes of comparison the averages of all the results are given. Full details of the tests will be found in the article above referred to.

1 year	265	220	284	266	210
	254	243	300	290	240
	250	224	288	282	230
	222	236	276	270	222
	232	220	294	298	216
Average	245	228	288	281	224

Averages of tests of mortar of limoid and Nazareth Portland cement.

Seven Days—1½ limoid, 1 part Nazareth, 81 pounds; 1¼ limoid, 1 part Nazareth, 101 pounds; ¾ limoid, 1 part Nazareth, 119 pounds; ½ limoid, 1 part Nazareth, 129 pounds; 1 part limoid, 1 part Nazareth (special), 137 pounds.

Twenty-eight Days—1½ limoid, 1 part Nazareth, 134 pounds; 1¼ limoid, 1 part Nazareth, 144 pounds; ¾ limoid, 1 part Nazareth, 173 pounds; ½ limoid, 1 part Nazareth, 179 pounds; 1 part limoid, 1 part Nazareth (special), 169 pounds.

Eighty-eight Days—1½ limoid, 1 part Nazareth, 148 pounds; 1¼ limoid, 1 part Nazareth, 154 pounds; ¾ limoid, 1 part Nazareth, 217 pounds; ½ limoid, 1 part Nazareth, 181 pounds; 1 part limoid, 1 part Nazareth (special), 174 pounds.

One Year—1½ limoid, 1 part Nazareth, 245 pounds; 1¼ limoid, 1 part Nazareth, 228

Portland Cement Manufacturers Building at Louisiana Purchase Exposition.

The Association of Portland Cement Manufacturers of the United States is erecting a building on the grounds of the Louisiana Purchase Fair to illustrate the possibilities of cement and concrete construction. In addition to an exhibit hall and testing laboratory, a hall has been set apart as a meeting place for engineers visiting the fair who are interested in cement construction. In this room general cement literature will be kept on file.

Investigation of Stream Pollution by Wood Pulp Mills.

An investigation of the waters of Lake Champlain and of the rivers emptying into it has been commenced by Col. William S. Stanton, of the United States Corps of Engineers, who is acting under orders from Secretary Root. M. O. Leighton, chief of the Division of Hydro-economics of the U. S. Geological Survey, of the Department of the Interior, has asked for funds to build a laboratory on the lake so that the matter of its pollution by pulp mills may be thoroughly investigated. Maj. C. L. Woodbury and assistants under orders from Col. Stanton, have taken up quarters on the lake and have begun chemical tests. Visits to the Au Sable and Boquet rivers and Ticonderoga Creek, on which the pulp mills are located, have developed amazing results caused by the refuse from the mills.

A City Beautiful.

The plan which the American Institute for Social Service was invited to submit for the carrying out of the Carnegie-Dumferline trust, has been made public. It provides for a regional museum, a district for a city beautiful, a social center, a department of civics, boys' and girls' flower gardens, children's playgrounds and out-door gymnastics, holiday tours and historic pilgrimages, get-together clubs, and a system of awards and prizes. The general outline of a city beautiful

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MUNICIPAL LITERATURE

Grand Rapids Annual Report.

Thirtieth annual report of the Board of Public Works of Grand Rapids, Mich., for the year ending April 30, 1903. W. Millard Palmer, mayor; Joseph Emmer, president; L. W. Anderson, city engr.

Like too many city reports, this one appears a long time after its date. The report is apparently transmitted to the Council May 1, 1903, and it would seem possible to print the seventy pages which it contains in less than eight months.

The board manages the water and light plants and constructs the street and sewer improvements.

The total receipts of the water works were $135,540, including $20,180 from the city funds. The disbursements were $132,272, maintenance and operation taking $55,694, construction $37,219, and interest $39,206. The average amount of water pumped was 12,216,000 gallons a day. The number of hydrants in use is 1,371, making the cost to the city, based on the appropriation to the works for general purposes, only $13 each per year, certainly a reasonable amount.

The city lighting plant now operates 599 lamps. The cost of operating would have been about $1.25 a lamp a year less, except for the high price of coal, which increased the cost $3.65 over the year before. Operation of the plant cost $24,958.20, which is $43.40 per lamp per year. Interest and repairs to towers increase the cost to $31,290, or $54.40 per lamp per year. Adding $10,000 for depreciation (5 per cent. on $200,000) makes the cost $71.80 per lamp per year. The interest is computed only on the $125,000 of indebtedness and the "lost taxes" are not considered.

During the year about three-fifths of a mile of asphalt was laid at a cost of about $35,000; about three-fourths of a mile of brick, costing nearly $32,000; 634 feet of Portland cement concrete street, eighteen feet wide, at a cost of $2,000. The former concrete streets are reported in good condition except that the joints are a weak spot and should be reduced to a minimum. About 4.58 miles of 8 to 24-inch pipe sewers were constructed at a cost of $29,976. The total payments during the year for public improvements, some having been completed the previous year, was $196,579, including streets, sewers, bridge repairs, new bridges, water mains and a fire department house.

ORGANIZATIONS AND INDIVIDUALS

Ohio and Indiana Engineering Societies—New England Water-Works Association—American Society of Civil Engineers—Technical Meetings—Personal Notes.

Ohio Engineering Society.

The twenty-fifth annual meeting of the Ohio Society of Surveyors and Civil Engineers was held in Columbus, Jan. 12 to 14. Owing to the death of the Secretary, Mr. B. H. Flynn, the affairs of the society were in a somewhat unsatisfactory condition and no program had been prepared. The meeting, therefore, assuming the nature of an informal discussion of the needs of the society and of the profession throughout the state. Mr. J. H. Turner presented a paper on the "County Surveyor," Mr. E A. Kemmler read a short paper on "The Welfare of the Society." The society was entertained by the Columbus Engineers' Club and an interesting description of the water purification plant of the East Jersey Water company, illustrated with stereopticon views, was given by Mr. R. H. Gregory. Fourteen new members were admitted

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and the following officers elected for the coming year:

President, J. W. Payne, Akron, O.; vice-president, J. H. Turner, Jackson, O.; secretary and treasurer, E. G. Bradbury, Columbus, O.; trustees, J. H. Asher, London, O.; A. F. Cole, Marietta, O.; H. J. Walker, Troy, O.; J. M. Harper, Cincinnati, O., and P. R. Murray, New Philadelphia, O.

A committee was appointed to confer with members of the State Legislature in regard to the present unsatisfactory statutory provisions. The question of a tri-state meeting with the societies of Michigan and Indiana was considered, and the president and secretary were instructed to correspond with these organizations in regard to the same.

Indiana Engineering Society.

The twenty-fourth annual convention of the Indiana Engineering Society was held at Indianapolis Jan. 14, 15 and 16. The advisability of the Indiana Society joining the National Association was discussed and it was decided not to do so this year. R. L. Sackett of Richmond delivered the annual address, which was on the "Evolution of Engineering." He said that while the constructing engineer has always been a factor in the progress of the race, he is, in his present character, a recent product of conditions. In the beginning he was but a hewer of wood and a drawer of water; now he does these same things, but on a gigantic scale. High ability to design seems only limited by the capital of the financier. He is now the servant of humanity, providing rapid and safe transportation and building great bridges which have been important factors in the unification of our country. Not one of the superb structures which now span the Ohio and Mississippi existed at the opening of the civil war. In referring to sanitary engineering he said that it was saving thousands from the ravages of disease, and that the purification of water and sewage are prolonging the life and promoting the happiness of the people.

Prof. William D. Pence presented a paper on "The Relation of the Railway Profile to Locomotive Power," in which he said:

The difference between the operating profile and the actual profile is very commonly ignored by railway civil engineers. This is in part due to the fact that the civil engineer is frequently unfamiliar with the fundamentals connected with the operation of locomotives and trains over the line which he locates and builds, and perhaps maintains, and which he is called upon to revise and improve. The trouble is that the civil engineer has often been so occupied with the construction or 'pick and shovel" part of the problem, that the operation or "locomotive" part of it receives little attention. In other words, the "haul" that he has in mind in locating and building the line is that of earthwork yardage from cut to fill, rather than that of trains over the finished line. But the civil engineer who locates and builds the road and improves its grades should have more than a mere superficial knowledge as to the operating ability of the locomotives which are to haul trains over the line. The entire practicability, as well as the business sense, in natural co-operation of this sort is fully evidenced by the splendid economies accomplished on some roads under such a system.

The term "operating profile" may refer to either freight or passenger service. Generally, however, the ruling or critical conditions, are imposed by freight service, and it is customary to discuss the profile first on that basis; afterward testing doubtful portions, perhaps, with reference to passsenger train conditions. Two general steps are involved: 1. The determination of the tonnage of the train which the given locomotive can steadily pull up an assumed or prescribed maximum grade of indefinite length, at a maximum speed of say seven or ten miles an hour, which speed is intended to give a slight margin above the stalling conditions. 2. To test the operation of this train under all conditions of service, from starting at stations or elsewhere, to the maximum speeds in sags and on large grades.

The report of the committee on stream pollution was submitted by A. J. Hammond, in which the statement was made that farmers had won suits where refuse has rendered water unfit for animals to drink. This tends to keep the subject alive and to force the government and the factory owners to realize that the problem of abating the nuisance must be met. Special studies will be made at Lafayette of the water from Wabash River before and after the starting of a strawboard factory, and studies will also be made as to the effects of sewage pollution.

A paper was then read from M. O.

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Leighton of the United States Geological Survey on "Stream Pollution in Indiana, with Special Reference to the Purification of Strawboard Refuse," in which he favors a policy of persuasion and education of the strawboard interests, and claimed that the practical results of this policy during the last year have been far greater than the results obtained by years of hostile litigation.

The discussion of the report and paper was opened by Prof. Hoffman, who recalled the case at Anderson, where the river is polluted by strawboard refuse, slaughter-house refuse and the waste acids from the tin-plate and rod mills. Comparatively little importance is attached to these acids, however. Dr. J. N. Hurty, secretary of the State Board of Health, spoke and while he scored the strawboard interests for polluting the streams, he cited other serious offenders. He stated that the city of Indianapolis is the worst of these, and the condition of the river at this city is indescribably foul, as well as very dangerous. The river has a series of pools and shoals, or "ripples," and these holes contain thick beds of sewage, being, in fact, a series of septic tanks, with the result that in many places fish cannot live in the water. Dr. Hurty favors government action to compel the establishment of improved methods, as he did not think the city would ever undertake any improvement without such outside pressure. The farmers are also largely responsible for pollution, and particularly for the spread of hog cholera.

The number of members of the society is now 111. The next meeting will be held in Indianapolis, Jan. 12, 13 and 14. Officers were elected as follows: President, R. L. Sackett, Richmond; vice-president, J. B. Nelson, Indianapolis; trustees, R. P. Woods and J. W. Fulwider; secretary, C. C. Brown.

New England Water Works Association.

The annual meeting of the New England Water Works Association was held in Boston, Jan. 13. The annual report of Secretary Willard Kent showed that the membership is now 528, three honorary members and fifty-five associates, making a total of 586. This is one less than the association had one year ago. Officers were elected as follows: President, R. J. Thomas. Among the papers submitted was one by W. C. Hawley on "Some Notes on the Cost of Waterproofing Concrete Lining of Reservoirs," in which he referred to the recent use by the United States government of two coats of linseed oil applied to the concrete surface as an expensive process, still in an experimental stage as to permanency of results. He then took the Sylvester process and modifications thereof. In this process a wash of soap is followed, after an interval, with a wash of alum in solution. Under the direction of Edward Cunningham, assistant engineer, the Apollo Water Works Company recently plastered a leaky clear-water well with a cement mortar containing soap and alum with good results. The Pennsylvania Water Company used washes of soap and alum to stop leaks in a concrete reservoir lining back of Braddock, Pa. In building a new reservoir near Wilmerding, Pa., a concrete lining has been made waterproof by mixing caustic potash and alum with the finishing coat of cement mortar. William Lyman Underwood read a paper on "Mosquitoes, With Suggestions for their Extermination," in which he described the life and habits of mosquitoes and explained the efficiency of drainage and petroleum films as exterminators. He also alluded to the use of pyrethrum powder burned to mitigate the mosquito nuisance in a closed room or on a piazza. Freeman C. Coffin, C. M. Saville, Frank E. Merrill, Patrick Kieran and H. V. Mackey were appointed a committee to collect data on the subject of meter rates.

American Society of Civil Engineers.

The annual business meeting of the American Society of Civil Engineers was held Jan. 20 at the Carnegie Lyceum. The report of the Board of Direction on the subject of joint building for the various engineering societies was presented and its discussion occupied the greater part of the meeting. The only definite result of the discussion was the passage of two resolutions, as follows: "1. Resolved, That the Board of Direction be instructed to issue a letter-ballot, to be canvassed at the meeting of the society, March 2, 1904, on the question whether this society shall become one of the constituent societies in the occupancy and control of the proposed engineering build-

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proceed in the matter, provided the exemption from taxation of the proposed building is assured and the interests of the society are otherwise fully safeguarded." Officers were elected as follows: President, Charles Hermany; vice-presidents, F. S. Curtis and S. L. F. Deyo; treasurer, Joseph M. Knap; directors, Charles S. Gowen, N. P. Lewis, John W. Ellis, George S. Webster, Ralph Modjeski and C. D. Marx.

Technical Meetings.

The Wisconsin Clay Workers' Association will hold its fourth annual meeting at Portage, Wis., March 1, 2 and 3.

The eleventh annual meeting of the Michigan Gas Association will be held in Saginaw Feb. 17 and 18. Papers will be read as follows: "A Few Notes on Ammonia," F. E. Sheriff, Battle Creek, Mich.; "The Laying of High and Low Pressure River Gas Lines," H. C. Morris, Bay City, Mich.; "The Laying of Mains and Services and Recording of Same," John Hellen, Grand Rapids, Mich.; "Care of Benches and Results Therefrom," Thomas J. Whalen, Jackson, Mich.; "Advertising: As Advantageous to the Gas Business," A. P. Ewing, Detroit, Mich.; "A Report of Progress on the Study of Naphthaline," Samuel Ball, University of Michigan.

The convention of the Minnesota Municipal and Commercial League will be held at St. Paul Feb. 17 and 18. L. A. Rosing of Cannon Falls is president.

The annual meeting of the St. Paul Civil Engineers' Society was held Jan. 11. New Officers were re-elected as follows: President, A. R. Starkey; vice-president, Oscar Claussen; secretary, A. L. Annan; treasurer, L. P. Wolff; librarian, C. L. Winslow.

At the annual meeting of the Municipal Art Society Jan. 13, at Baltimore, Md., Frederick Law Olmstead of Boston delivered an address, accompanied by stereopticon views. Daniel C. Gilman, Michael Jenkins, John N. Steele and J. B. Noel were re-elected directors of the society.

The Twenty-fifth annual meeting of the Michigan Engineering Society was held at Lansing Jan. 12, 13 and 14. Papers were read as follows: "Choice of a Water Supply," by Mr. W. W. Brigden; "An Electric Driven Pumping Plant," by Mr. J. De Young; "Pure Water Supply," by Mr. F. G. Frink; "Bitulithic Pavement," by Mr. W. A. Hoyt; "Propagation of Hot and Cold Waves Down Into the Earth," by Mr. A. C. Lane; "Practical Heating Tests of Coal," by Mr. F. B. Platt; "The Hot Air Furnace," by Mr. John R. Allen; "Building a City," by Mr H. K. Whitney; "County Surveyors' Records," by Mr. B. F. Dorr; "Gas Engines," by Mr. W. H. Patton; "Engineering Experiences," by Mr. B. E. Parks; "Some Rivers of the Upper Peninsula," by Mr. Charles Cummings; "Sewerage Laws in the Last Legislature," by Mr. H. E. Baker; "Concrete-Steel Bridge Construction," by Mr. P. A. Courtright.

Committee reports were submitted on the following: The Relation of Sewerage and Water Supply to the Public Health; Forestry; Enginering Features of Municipal Work to be Protected by Ordinance; Roads and Paving; Questions of Land Surveying; Electric Railway; Topographical Survey of the State.

Officers were elected as follows: President, Dorr Skeels of Grand Rapids; vice-president, Prof. H. C. Vedder of Michigan Agricultural College; secretary-treasurer, F. Hodgman of Climax.

The annual meeting of the Massachusetts highway association will be held at Boston February 9. A. B. Fletcher, secy., 20 Pemberton Square, Boston.

Personal Notes.

W. J. Olwell was inaugurated mayor of Davenport, Wash., Jan. 13.

F. P. Cobb has been reappointed city engineer at Chicopee, Mass.

L. E. Farnham has been reappointed city engineer at Camden, N. J.

Henry L. Haines has been elected city surveyor at Burlington, N. J.

Julius F. Frehsee has been reappointed city engineer at Lockport, N. Y.

Winslow L. Webber has been re-elected city engineer at Gloucester, Mass.

W. H. Thorne has been appointed superintendent of streets at Brockton, Mass.

David M. Earle, jr., has been appointed assistant city engineer at Worcester, Mass.

Alfred L. Black has been elected first Mayor of the new city of Bellingham, Wash.

Edward L. Arundel has been elected president of the water board at Lawrence, Mass.

Harry S. Scull has been re-elected president of the City Council at Ventnor, New Jersey.

Andrew J. Kirwin has been re-elected chief engineer of the fire department at Newport, R. I.

George T. Ingersoll has resigned as superintendent of the water department at Schenectady, N. Y.

J. Walter Ackerman was reappointed city engineer at Auburn, N. Y., Jan. 4 by the common council.

Frank Ward has been elected city clerk at New Brunswick, N. J., to succeed George H. Denizer, resigned.

William Hamilton has been re-elected

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street commissioner and William H. Lawton city engineer at Newport, R. I.

Walter E. Hassem has been elected street commissioner at Worcester, Mass., to succeed Wright S. Prior, resigned.

John P. Murphy has been elected mayor at Knoxville, Tenn., to fill out the unexpired term of the late J. T. McTeer.

John C. Wait has resigned his position as assistant corporation counsel in New York City and entered on the practice of law at 220 Broadway, New York City.

Robert G. Post has been appointed president of the water department at Oswego, N. Y., to succeed Eliot B. Mott.

S. E. Monroe has resigned as city engineer of Binghamton, N. Y., which office he has held for twelve years. Mr. Monroe will be succeeded by S. M. Baird.

Samuel J. Prescott & Co., removed their offices to the northwest corner of Thirteenth and G streets, N. W., Washington, D. C.

Dr. Philip H. Grier, who was mayor of Elizabeth, N. J., from 1862 to 1871 died at Trenton, N. J., Jan. 2, aged about 74 years.

J. H. Gregory has been appointed assistant to Julian Griggs, city engineer at Columbus, Ohio, in charge of designs for sewage disposal works and a large storage dam.

Presidents of water commissions have been elected as follows: F. O. Tompkins, Middletown, N. Y.; Edward L. Arundel, Lawrence, Mass.; Patrick Convery, Perth Amboy, N. J.

Hon. Joseph T. McTeer, mayor of Knoxville Tenn., died in New York City Jan. 6, where he had been for several months under a surgeon's care.

James Thompson has been elected mayor at Walhalla, Wash. J. R. Veal, W. L. Verner, D. H. Rowland, W. D. Moss and John F. Craig were elected aldermen.

C. B. Helmick has resigned as city engineer of Hannibal, Mo., and chief engineer of the plants of the Atlas Portland Cement Company, to accept a position in the governmental service at Cheyenne, Wyo.

L. A. Nicholson has been appointed city engineer at Tacoma, Wash., to succeed Norton L. Taylor, whose term expired Jan. 1. Mr. Nicholson is a member of the firm of Nicholson & Bullard, civil engineers and architects.

Mr. Dabney H. Maury, Consulting Engineer, while still retaining his connection with the Peoria Water Works Company as its engineer and superintendent, as well as his office for private practice at 129 N. Jefferson-ave., Peoria, Ill., has recently opened another engineering office at 126 Liberty-st., New York City.

Mr. Irving H. Reynolds, formerly with the Allis-Chalmers Company and for many years in charge of their pumping engine department has accepted a position with the William Tod Company of Youngstown as consulting engineer and is in charge of the department devoted to the building of large high duty crank and flywheel pumps, giving most of his attention to this branch of the business.

The Hon. George B. McClellan was inaugurated Mayor of New York City Jan. 1 and has made appointments as follows: Park commissioners, John J. Pallas for Manhattan, William P. Schmitt for the Bronx, Michael J. Kennedy for Brooklyn and Queens; bridge commissioner, George E. Best; commissioner of water supply, gas and electricity, John T. Oakley; street commissioner, John McGaw Woodbury.

MACHINERY AND TRADE

A Sand Bed for Curing Cement Block.

The Fisher Hydraulic Stone System new includes a wet bed of sand on which

A Perpetual Memorandum Book.

All persons engaged in construction work, engineers, architects, contractors,

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er's name in gold on the cover at a low price. A full description of the book will be found in their advertisement in this number of Municipal Engineering. The cover is handsome and durable and the pads can be renewed as often as necessary or exchanged when different rulings are needed. Municipalities and firms frequently supply the books to their officials and employes and customers. Samples of the rulings used show that any ordinary use for such a book can be met by choosing a suitable design from those presented.

Plans for Drying Materials.

The United States Drying Engineering Company, 66 Beaver-st., New York City, is a firm of engineers that prepares plans for dryers for all purposes and gives attention to the particular requirements of each case, including such products as cement, clay, marl, slag, coal, peat, etc. Not being interested in any particular dryer, the firm recommends at all times that which is best suited to the case under consideration. Specifications and data will be furnished on receipt of particulars of operation.

Trade Publications.

The American Hydraulic Stone Company, Denver, Colo., issues an illustrated pamphlet on the "Revolution in Building," describing its machinery and methods for making artificial stone, and showing a number of buildings constructed therewith.

The Pope Bicycle Daily Memoranda Calendar has again made its appearance, showing that A. A. Pope is again at the head of the bicycle business so long conducted by him. The corporation is known as the Pope Manufacturing Company, Hartford, Conn.

Port Huron road-building machinery is illustrated in the new catalogue of the Port Huron Engine nad Thresher Company of Port Huron, Mich.

The F. W. Dodge Company, 289 Fourth-ave., New York City, has published the "Building and Engineering Trades Directory" for 1904, containing lists of architects, engineers, builders, contractors and others interested in construction in the city of New York. Further notice will be given the book later.

Industrial Railways are shown in all their details in the new catalogue of the Hoshor-Platt Company, 120 Liberty-st., New York City.

The Spaulding Print Paper Company, Boston, Mass., issues a catalogue of its Federal blue-printing machines for printing by electric light.

The Charles Warner Company, Wilmington, Del., sends a handsome picture with a birds-eye view of the Cedar Hollow and Whiteland lime plants with the surrounding country.

Tonindustrie-Kalender, 1904, is a convenient pocket calendar, with a second part which is a book of nearly 800 pages full of information about the various machinery and processes used in the clay and cement industries and lists of the prominent German manufacturers.

Catalogue No. 1,018 of the Atlas Car and Manufacturing Company, Cleveland, O., describes their mine and ore cars, and dump cars of every description, and the apparatus for operating them.

The Jeffrey grab bucket for handling ore, coal, broken stone, gravel, sand, etc., is fully illustrated and described in circular No. 77 of the Jeffrey Manufacturing Company of Columbus, O.

Catalogue No. 9 of the C. O. Bartlett & Snow Co., Cleveland, O., illustrates their interlocking shoulder bearing chain belts for use in cement mills, rolling mills, mines, etc.

TRADE NOTES.

ASPHALT.

The Lake Erie Asphalt Block Company resumed operations at its plant in Ironville, Jan. 6. The plant has been shut down since last November on account of a scarcity of material.

The Lake Erie Asphalt Block Company of Toledo, O., has elected officers for the ensuing year as follows: President, C. H. Burchinal; vice-president, J. B. Battelle; treasurer, H. C. Burchinal; secretary, Arthur Weller.

About 2,100 acres of asphalt lands in the Tishimingo quadrangle in Indian Territory, are for sale, and the folio, which is No. 98 in the series, may be obtained for 25 cents on application to the director of the United States Geological Survey, Washington, D. C.

The Federal Asphalt Company of Chicago has filed a mortgage at Elizabethtown, Ky., of $500,000 to the American Trust and Savings Company of that city, on its asphalt lands in Hardin and nearby counties. The company will begin at once to develop its property.

A press report from Galveston, Tex., states that a stratum of asphalt has been discovered by the United States dredge boat, General Comstock, off the mouth of the Jetties, and that the discovery confirms the belief that a vast bed of asphaltum underlies the coast between Galveston and Sabine Pass.

Press reports from Tampico, Tex., state that A. L. Barber of New York City, formerly of the Barber Asphalt Company, accompanied by experts, has just finished

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an investigation of the deposits of asphalt in the vicinity of Tuxpan, near the Gulf coast, and has purchased about 800,000 acres of land upon which these deposits are found. The field is said to be the most extensive in asphalt deposits in the world.

Major George H. Walton, stastistical expert of the State Department of Agriculture, Austin, Tex., has made an investigation of the underground asphalt lake situated near St. Joe, Tex., and states that liquid asphalt is oozing from the ground in several places. He believes that the lake exists at a depth of about 150 feet, and says that hundreds of tons of solidified asphalt lie on the surface of the ground.

A supp'emental contract has been made with Hetherington & Berner of Indianspolis for an asphalt plant for the city of Detroit, Mich. The supplemental contract settles the suit brought against the city and provides for the taking of the plant under the contract made by that firm with the city, according to local press reports. The plant will have a capacity of 2,000 sq. yds. daily and will cost $15,500.

Henry Tatnall, receiver of the Asphalt Company of America, has caused an attachment to be issued against Harry C. Spinks, fixing bail in the sum of $40,000 and summoning the Land Title and Trust Company as garnishees. This action is explained by the fact that the property of Mr. Spinks, valued at $40,000, is said to be held by the Land Title and Trust Company, and that an attempt will be made to recover this for a sum which Mr. Spinks did not pay when the court's call for $40 per share on asphalt stock was made. Mr. Spinks held 1,000 shares.

BRICK.

Fred H. Shelton, Pennsylvania Building, Philadelphia, Pa., desires the names and addresses of firms making briquette machinery.

The Anniston Brick, Tile and Pottery Company, Anniston, Ala., is to be organized, with E. P. Heifner of Atlanta, Ga., at its head.

The American Process Company has just installed a direct heat sand dryer for the Granite Brick Company at Glens Falls, N. Y. They are manufacturers of brick under the Huennekes system.

The Southern Hydraulic Brick Company, Charleston, S. C., began operations Jan. 8. E. H. Jahnz is president and W. F. Sauls is superintendent of the plant. Paving brick will be manufactured also.

The Delaware Cement Brick Company is enlarging its plant at South Wilmington, Del. The addition is being compressed brick and drain tile. A number of local men will be associated with Mr. Stiver.

CEMENT.

The Aetna Cement Company, Fenton, Mich., contemplates enlarging its plant by the installation of new rotaries.

W. H. Oliver of Stephensburg, Ky., contemplates the manufacture of Portland cement from deposits in that community.

The Portland Cement Works, six miles west of Florence, Colo., will resume operations about Feb. 1, according to press reports.

The office, drafting-room and laboratory of the Pennsylvania Cement Company, near Bath, Pa., were destroyed by fire Jan. 14. Loss, $20,000.

H. A. Mayo and others of Walhalla, N. D., are interested in the proposed establishment of a plant to manufacture cement, hollow brick, tiling, pressed brick, etc.

A petition in bankruptcy was filed in New York City Jan. 3 by Sears, Humbert & Co., cement manufacturers, showing liabilities of $204,577 and assets of $150,960.

The Ajax Portland Cement Company, Trenton, N. J., was incorporated Jan. 8 by Hiram C. Bennett and Edward H. Bennett of New York City and H. B. Starrett of Bayonne, N. J.

Edward A. Kingsbury, Syracuse, N. Y., has severed his connection with the Empire Portland Cement Company at Warner, N. Y., to accept a position with the Hudson Portland Cement Company.

Bankruptcy proceedings have been instituted against the Texas Portland Cement and Lime Company at Galveston, Tex. The total of the liabilities is $200,321 and the assets amount to $295,098.

The machine shops of the Alabama Portland Cement Company at Demopolis, Ala., were burned recently, involving a loss of $3,500. The shops will be rebuilt and equipped with new machinery.

The Cement Products Company, Binghamton, N. Y., has been incorporated by John Hull, jr., Mark S. Hotchkiss, Oscar Heller, William H. Lockwood, Harry W. Edson, Benjamin F. Welden and Fred Matthews.

Samuel Horner of Philadelphia, Pa., has purchased 816 acres of land near Louisville, Ky., and will establish a cement plant costing $1,000,000. The plans include the establishment of a new town for the employes.

The Shreveport Sand and Cement Company, Shreveport, La., is ready to commence business. The company deals in sand and cement and will make estimates on concrete sidewalks. C. W. Lane is

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construction company, organized the cement company.

H. R. Van Wagoner of Linden, Mich., has purchased 500 acres of marl land near Cohoctah and will erect a cement plant within the next year. Detroit and other capitalists are interested. Mr. Van Wagoner is of the opinion that a good quality of marl also exists in the Big Swamp in Davison township, Genesee County.

The Cement Construction, Floor and Sidewalk Layers' Union, Local No. 1, Chicago, has elected officers as follows: President, Geo. Cease; vice-president, Fred Hirt; recording secretary, Martin Nolan; treasurer, Edward Olson; trustees, Otto Wallin, James McIntyre, and P. Mackin; business agent, P. H. Malloy.

The plant of the Edison Portland Cement Company, near Washington, N. J., will not begin operations Feb. 1 as planned, but has fixed June 1 as the time for starting its works. The plant was erected last year at a cost of more than $3,000,000, and its manufacturing has, so far, been principally experimental. Thomas A. Edison is at the head of the company.

W. H. Harrison, Laverty, O. T., says that no company has yet been formed to work the cement beds, but it is thought that one will be organized soon. An unlimited supply of cement, adjacent to the Frisco Railroad, exists there and the farmers in the vicinity are very anxious for a cement plant to be located. Mr. Harrison desires to communicate with any person or company who would care to investigate the matter.

Thomas Pray, jr., Boston, Mass., as trustee, has for sale about 750 acres of land, located on the Illinois Central Railroad, between sixty and seventy miles southwest of Louisville, Ky., on which large quantities of clay, limestone, etc., all the factors for making first-class Portland cement, exist. The property is within a mile of a town, has water for all steam and other purposes, and the I. C. Railroad runs for a mile through the property. Address Thomas Pray, jr., P. O. Box 2809, Boston.

A petition was filed in the United States Court at Bay City, Mich., Jan. 12, by U. R. Loranger, asking that the Detroit Trust Company and the Hecla Portland Cement and Coal Company be required to deposit the books in court for examination. It is alleged that the Hecla Portland Cement Company has failed to defend the suit against it to foreclose the $750,000 mortgage; that Mr. Loranger was permitted by the United States Court on Dec. 21, 1902, to make the defense which the directors of the company were neglecting to make, and that in order to prepare for such defense it is necessary that the books be gone over by experts. The petitioners are Reeves Bros.' Company of Alliance, O., whose claim amounts to $27,289; Fulton Bag and Cotton Mills Company, New York City, and W. M. Fink Company of Detroit.

CONCRETE BLOCKS.

The Saal Concrete Company, Pekin, Ill., is preparing to manufacture concrete building blocks.

The Aberdeen Artificial Stone Company, Aberdeen, Wash., has been organized to manufacture building blocks.

The Frost Concrete Stone Company, Downs' Ia., has been organized to manufacture building blocks under patents of R. T. Frost.

A plant is being erected at Escanaba, Mich., for the manufacture of cement blocks for building purposes, according to press reports.

Henry J. Dexter of New York City will locate a plant in New Albany, Ind., for the manufacture of building block from shale, cement and other materials.

A plant for the manufacture of hollow concrete building blocks will be established in Joliet, Ill. Charles L. Wallace is interested in the proposed new industry.

The Duluth Hollow Concrete Building Block Company, Duluth, Minn., has been incorporated by Frank McCormack, Napoleon Grignon, William Clifford and Thomas H. Mackle.

The Stevens Cast Stone Company, manufacturers of litholite, Chicago, Ill., has received word from its company in Toronto, Ont., stating that two Carnegie libraries and several bank buildings have been built entirely of its stone. Several plants have been established in New York state by Charles H. Lockard of Syracuse.

The Miracle Pressed Stone Company, manufacturers of pressed concrete building blocks and machinery, Sioux Falls, S. D., has opened a general office at 602-603 Northwestern Block, Minneapolis, Minn., and will handle the company's business from that point. O. U. Miracle, president, R. O. Miracle, secretary and treasury.

The Granilite Manufacturing Company, Kansas City, Mo., has been incorporated to manufacture a general line of cement products, including hollow building blocks, ornamental work, roof tiles, burial cases, posts, etc. The company will also do a general contracting business in paving, curbing, steps and porch work. The officers of the company are: President, L. W. Bigs; vice-President, A. D. Burrows; Secretary and Treasurer, Homer B. Mann; General Manager, B. L. Simpson; Superintendent of Construction, J. W. Cable. The company's temporary address will be 406 K. C. Life Building.

LIGHTING AND POWER.

The Sangane Electrical Company of Springfield, O., will open a factory in the White Block at Windsor, Ont., for the manufacture of electric motors.

The Parker Engine Company, 1041 Drexel Building, Philadelphia, Pa., has just equipped the Philadelphia Rapid Transit Company, at Second and Wyoming-sts., with six 641 horse-power boilers

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and are building two 87½ horse-power for another plant.

Newly incorporated lighting companies Standard Light & Heat Company, Jersey City, N. J.; Gillet Light Company, Chicago, Ill.; Triumph Light Company, Brooklyn, N. Y.; Shelbyville Water, Light & Heat Company, Shelbyville, Ill., Detroit Electric Light Company, Detroit, Tex.

The Moline Incandescent Light Company has been organized at Moline, Ill., with officers as follows: President, C. H. Deere; vice-president, E. E. Morgan; secretary, and treasurer, C F. Grantz; general manager, A. H. Kreitler. The removal of the plant from Owensboro, Ky., will begin at once and it will be in operation by the middle of February.

The Hudson River Electric Power Company, Queensbury N. Y., has been incorporated. The company's interests will be identical with the Hudson River Water Power Company, the Hudson River Electric Company, and the Hudson River Power and Transmission Company, in all of which Eugene V. Ashley, of Glens Falls, is actively interested.

The Holthoff Machinery Company of Cudahy, near Milwaukee, Wis., and the Loomis Pettibone Gas Machinery Company of New York, will consolidate and will conduct the business under the name of the Power & Mining Machinery Company. The company's specialty will be gas engines. Benjamin Guggenheim, of New York will be president; H. C. Holthoff, vice-president; B. T. Leuzander, secretary and treasurer.

MISCELLANEOUS.

J. M. Williamson, Bloomington, Ill., has sold his concrete walk and curb plant to George L. Bozath.

The Number Eight Reservoir Co., Ft. Collins, Colo., has been incorporated by Benjamin H. Eaton, Bruce G. Eaton and Ellis Smith.

L. L. Leslie, Cleveland, S. D., contemplates building a plant in Sioux Falls next spring for the manufacture of cement fence posts.

James F. Connelly, city clerk of Newark, N. J., and John H. McLeod have jointly invented a device to be used in connection with voting machines.

The National Valve Company, Sandusky, O., is being incorporated to take over the Vincent Valve Company. John G. Schurtz, president; William E. Guerin, jr., secretary.

Bridge contractors will be interested in the desire of Peoria to build a new bridge across the Illinois river at Bridge-st. and may be able to help the city finance the proposition.

Russell Clark of New York and Charles of the same place, are now in the field soliciting orders for high-grade malleable castings.

The Plymouth Rock Granite Company, St. Cloud, Minn., has been incorporated by Homer J. Brooks and Joseph F. Davis of St. Cloud; Fred A. Michler, August Brief and Albin Anderson of Perham, Minn.

The Valley Stone Company, Schenectady, N. Y., has been incorporated to construct public works by J. W. Potter of Marcy, F. E. Swancott of Utica, August, John and Alanson Robison of Schenectady and Alonzo Schaupp of Albany.

The Republic Creosoting Company of Minneapolis, Minn., has been incorporated to manufacture paving materials and wood preservatives by Peter C. Reilly and James Broden of Indianapolis, and Alexander W. Van Hoffen of Minneapolis.

Sealed proposals will be received by the Cienfuegos, Palmyra & Cruces Electric Power and Railway Company, Havana, Cuba, until March 15, for furnishing 4,400 tons of steel tee rails, 1,200 kegs of spikes, 14,100 electric rail bonds, 105,000 creosoted railroad ties, 4,100 trolley poles, 15,000 barrels Portland cement.

Patent on a new cement shingle, which it is claimed will ultimately displace wooden shingles, has been granted George C. Zwerk of Saginaw, Mich.

The F. D. Cummer & Son Company of Cleveland, O., since Nov. 15, 1903, has received orders for twelve of its Cummer dryers, nine of which are to be used in the United States; three go to foreign countries.

United States Drying Engineering Company has closed a contract with the Provincial Chemical Fertilizer Company of St. John, N. B., for the installation of a complete plant for the reduction of 50 tons of dog fish and fish offal per day, plant to be located in the Bay of Fundy, on an island near Digby, Nova Scotia. Construction to be commenced March 1.

Those interested can address the United States Drying Engineering Company, 66 Beaver-st., New York City.

The C. O. Bartlett and Snow Company, Cleveland, O., has received an order from the Dakota Pressed Brick Company, Deadwood, S. D., for a rotary dryer for drying fifty tons of sand a day, and also for conveying machinery. The company has also received orders for elevating and conveying machinery as follows: Iroquois Portland Cement Company, Caledonia, N. Y.; the Elk Rapids Portland Cement Company, Elk Rapids, Mich.; the Grasselli Chemical Company, Cleveland, O.; the Struthers Furnace Company, Struthers, O.; the Sandusky Portland Cement Company, Sandusky, O.; the Sher-

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IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Ft. Leavenworth, Kas.—About $12,000 worth of road machinery has been shipped here from Washington, D. C., and all of the government roads will be put in first-class condition.

Ritzville, Wash.—The constitutionality of the road law passed by the Legislature of 1903, wherein it sought to abolish the system of electing a road supervisor for every district in the county and place the matter in the hands of the County Commissioners with power to divide the county into four districts and appoint four supervisors at a salary of $4 per day, will be tested.

Camden, N. J.—Application was made to the Supreme Court, Jan. 18, for a rule to show cause why a certiorari should not be issued to review the action of the City Council of Atlantic City in awarding a contract for the paving of a number of streets to the Delaware River Quarry Construction Company. The complainants are Dixey, Marsh & Lane, who allege that the Delaware River Quarry Construction Company offered five bids for the work when the proposals only called for one, and the contract was awarded to the company for $197,000; that the city can only be bonded for $48,000 for this improvement and the total aggregate of the contract would amount to $200,000, being an excess of $150,000 over its bonded indebtedness. The rule was allowed and was made returnable Feb. 1.

CONTEMPLATED WORK.

Danville, Ill.—Paving is contemplated for College-st.

Wellston, O.—Brick paving is contemplated for three streets.

Stoneham, Mass.—The Board of Selectmen has been authorized to rebuild Franklin-st.

Elgin, Ill.—The property-owners of S. State-st. favor asphalt paving. Mayor Hubbard.

Brookville, Ind.—A resolution has been passed to pave Main-st. with vitrified brick.

Little Falls, Minn.—Paving is contemplated for the business streets.

Pomona, Cal.—The City Trustees have passed resolutions for paving a number of streets.

Spring City, Pa.—The Town Council has decided to pave Main-st. from New to Hall this spring.

LaCrosse, Wis. — Brick paving is proposed for Fourth-st. from King to Mormon Coulee road.

Piqua, O.—Paving is proposed for Wood-st. J. A. Miles, clk. coun.

Superior, Wis.—Paving is proposed for Twelfth-st. to the East End.

Atlanta, Ga.—Asphalt paving has been decided upon for Forsyth, Decatur and Mitchell-sts.

Stoneham, Mass.—The macadamizing of Franklin-st. has been authorized.

Alton, Ill.—The City Council reported on the proposed paving of several streets adjacent to Henry-st.

Atlantic, Ia.—The City Council has ordered the construction hereafter of stone, brick or cement sidewalks.

Harrisburg, Pa.—Mayor McCormick has recommended the paving of Cameron-st.

Ft. Smith, Ark.—The ordinance for paving Sixth-st. with vitrified brick was defeated. Mayor Kuper.

Freeport, Ill.—The property-owners on Stephenson-st. are in favor of brick paving.

South Haven, Mich.—This town voted, Jan. 20, to issue bonds for public improvements.

Duluth, Minn.—The bd. of pub. wks. contemplates paving portions of Seventh and First-aves. and Dingwell, Superior and Seconds-sts.

Beverley, N. J.—Brick paving is contemplate for ¾ mi. of a street. J. D. Fish, mayor.

Portsmouth, O.—Petitions are being circulated for paving Fourth-st. with brick and asphalt.

Kansas City, Mo.—A resolution has been adopted to pave Hammond-place, from Cleveland to Myrtle-aves. Baxter Brown, cy. clk.

Oldham, S. D.—The construction of several miles of new sidewalks during 1904 is contemplated.

Bay City, Mich.—Council has adopted estimates for paving Johnson-st., from Center-ave. to Second-st.

Mansfield, O.—Brick, block, asphalt and macadam paving is recommended for a number of streets.

Canandaigua, N. Y.—The property-owners on five streets have petitioned for paving. W. E. Martin, vil. clk.

North Adams, Mass.—The exclusive use of granolithic walks is recommended by F. B. Locke, cy. engr.

Fall River, Mass.—The highway dept. has asked the council for $380,000 for highways, curbing and paving.

Hartford Conn.—The bd. of pub. wks. has recommended the macadamizing of Mather-st., from Garden to Vine. Philip Hansling, jr., supt. sts.

Indianapolis, Ind.—The property-owners on Sixteenth-st., from L. E. & W. tracks

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to Roosevelt-ave., have petitioned for flint rock macadam.

West Bay City, Mich.—Plans are being proposed providing for paving Washington, Litchfield, S. Henry and Walnut-sts. Cy Engr. Thompson.

Freeport, Ill.—An ordinance has been passed providing for brick paving on William, Chicago, Oak-place and Van Buren-sts. Mayor Dittmar.

Grand Rapids, Mich.—Brick paving on concrete base is proposed for W. Leonard-st., from Alpine-ave. to the city limits, at a cost of $44,610.

Covington, Ky.—The reconstruction of a number of streets during 1904 with creosoted block and brick is contemplated. W. E. Gunn, cy. engr.

Livingston, Mont.—Bids will be received, according to press reports for constructing cement walks and crossings during 1904. Cy. clk.

Ogden, Utah.—A. F. Parker, cy. engr., has been authorized to prepare plans for ten blocks of concrete curb and gutter.

Louisville, Ky.—Ordinances were approved, Jan. 8, for paving and repaving the sidewalks on Gray, Washington and Preston-sts. with brick. Paul C. Barth, mayor.

Fort Smith, Ark.—Resolutions were adopted Jan. 20 for curbing with stone or cement and constructing flag walks on a number of streets. Henry Kupjer, Jr., mayor; D. B. Sparks, cy. clk.

Bay City, Mich.—Plans and specifications have been adopted for paving Johnson-st., from Center-ave. to Second-st., with vitrified brick on concrete base, with artificial stone curbing, at a total cost of $9,181.96. M. J. O'Malley, chm. B. P. W.

Marion, O.—(Special).—Geo. E. Dwyer, cy. engr., says that bids will be asked for about March 30 for 12.000 sq. yds. of asphalt block paving and March 1 for 9,000 sq. yds. of brick paving.

Newark, N. J.—The Hudson and Essex freeholders joint bridge committee decided, Jan. 21, to replace the wornout asphalt paving on the Fourth-st. bridge across the Passaic with wooden paving blocks.

Ithaca, N. Y.—A decision handed down by the court of appeals, Jan. 20, sustains all previous decisions regarding the improvement of E. Lawn-ave. and finds that it is a necessity. The road will now be built.

Mobile, Ala.—The cy. coun. adopted, Jan. 6, a new paving proposition which will include 30,382 sq. yds. of asphalt, 51,823 sq. yds. of brick, 29,746 sq. yds. of granite, and 11,578 sq. yds. of rectangular wooden blocks.

New Bedford, Mass.—Mayor Chas. A. Ashley recommends, in his annual mes-

Little Rock, Ark.—(Special.)—Gerhard Morgner, supt. pub. wks., says that 10 blocks of asphalt paving on W. Third-st. and 8 blocks of intersecting streets is concontemplated. Specifications have been prepared, but the time for receiving bids has not yet been determined upon. About 30 blocks of gravel streets will also be built by the city. The county proposes to build 19 blocks of macadam paving on Chester-st., but no contract will be le..

New Britain, Conn.—Bids will be asked soon for building 5,000 ft. of macadam road on East-st. W. H. Cadwell, cy. engr.

Utica, N. Y.—Resolutions have been introduced asking for the paving of Scott, Dakin, Steuben, Miller and Mortimer-sts. and other streets and avenues.

Springfield, Mass.—A. A. Adams, supt. st. dept. recommends the repaving of Main-st. from Hampden to State-sts.

Davenport, Ia.—Council adopted a new paving list Jan. 19, providing for the paving during 1904 of a large number of streets.

Springfield, O.—The residents will again agitate the question of paving Main-st. from Yellow Springs-st. to Western-ave.

Woonsocket, R. I.—A resolution has been introduced providing for an appropriation of $45,000 for paving Main and Cumberland-sts.

St. Joseph, Mo.—Paving is contemplated for Fourth-st., leading from the business section of the city to the stock yards district. Brick will probably be the material used.

Toledo, O.—An ordinance has been approved providing for paving Virginia-st. from Lawrence to Detroit-ave. and an alley between Huron and Erie-sts. from Washington to Monroe-sts.

Orlando, Fla.—The county board decided Jan. 7 to purchase 100,000 paving brick of the Clarcona Brick Company and experiment in paving the county roads.

Denver, Colo.—The paving contemplated for 1904 embraces a large number of streets and includes asphalt, crushed basalt, disintegrated granite and sidewalks.

Albany, N. Y.—Ordinances are pending providing for paving as follows: Dallius-st. from Madison-ave. to S. Ferry-st., granite blocks; Union-st. from Madison to Hudson-aves., vitrified brick.

Clarinda, La.—Final action will be taken Feb. 2 on a resolution to pave Main, Washington, Fifteenth and Sixteenth-sts. with vitrified paving brick on a concrete base. C. W. Foster, mayor; C. W. Stuart, cy. clk.

Rosedale, Kas.—(Special)—George Gerner, cy. clk., says that fifteen blocks of asphalt paving on concrete and ten blocks of brick paving on concrete are contemplated.

Dubuque, Ia.—A petition is being circulated in East Dubuque requesting the

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Gate Park and a road around the bay shore is proposed.

Cohoes, N. Y.—Bids will be received at a meeting to be held Feb. 10, according to local press reports, for paving Willow, Mangam, High, Vliet and Ontario-sts. and Younglove-ave.

CONTRACTS TO BE LET.

Paoli, Ind.—Bids are asked until 2 p. m. Feb. 5 for building gravel roads. George W. Teagarden, co. audt.

Jeffersonville, Ind.—Bids are asked until Feb. 11 for constructing 39 miles of county roads. George B. Parks, co. audt.

Lakewood, O.—Bids are asked until Feb. 2 for stone flagging and cement walks on Clifton Boulevard. H. J. Sensel, vil. clk.

Walla Walla, Wash.—Bids are asked until 3 p. m. Feb. 2 for grading and sidewalks at Oak and E. Oak-sts. R. P. Reynolds, cy. clk.

Bethlehem, Conn.—Sealed bids are asked until Feb. 16 for constructing a section of gravel road. F. P. Hayes, chmn. bd. selectmen.

Bellefontaine, O.—Sealed bids are asked until Feb. 4 for grading and macadamizing Horton Pike No. 2. James E. Shaw, chmn. co. comrs.

Rushville, Ind.—Sealed bids are asked until 2 p. m. Feb. 1 for building a macadam road in Richland twp. Marquis L. Sisson, chmn. co. comrs.

Harrisburg, Pa.—Sealed bids are asked until Feb. 10 for constructing 1,935 feet of road in Castanea twp., Clinton co. Penn. State Highway Dept.

Detroit, Mich.—Sealed bids are asked until 10 a. m. Feb. 1 for furnishing 1,500 tons of refined sheet asphalt. Wm. H. Maybury, comr. pub. wks.

Brownstown, Ind.—Bids are asked until Feb. 2 and 3, according to press reports, for constructing gravel roads. Asbury M. Manuel, co. audt.

Chattanooga, Tenn.—Sealed bids are asked until Feb. 15 for grading and constructing walks and roads at Chickamauga Park, Ga. H. W. French, Capt. Q. M.

Toms River, N. J.—Sealed bids are asked until Feb. 9 for building a gravel road in Union twp. 3.25 mls. long. James E. Otis, bd. chosen freeholders.

Chicago, Ill.—Sealed bids are asked until Feb. 3 for constructing cinder walks in a large number of streets. A. M. Lynch, prest. bd. local imprvts.

Greensburg, Ind.—Sealed bids are asked until Feb. 1 for building free macadamized roads in Clay, Sandcreek and Jackson twps. Frank E. Ryan, co. audt.

Findlay, O.—Bids are asked until Feb. 2 for vitrified brick or block paving on Elm-st., and block paving on W. Crawford-st. Frank C. Ray, cy. clk.

St. Bernard, O.—Sealed bids are asked until Feb. 11 for macadamizing Albert-st. from Bertus to Leonard, and constructing cement curbs and gutters. George Meyer, vil. clk.

Washington, Ia.—Sealed bids are asked until Feb. 9 for paving Iowa-st. from Main to Railroad-sts. with vitrified brick on concrete base. Hugh H. McCleery, cy. clk.

Santiago, Chili—Public bids will be opened July 1 for constructing pavements. Address Chilean Legation in Washington, D. C., or Chilean Consulate General, 135 W. Eleventh-st., New York City.

Spencer, Ind.—Sealed bids are asked until Feb. 1 for reletting Jefferson twp. pike contract. Bids will also be received at the same time for improving various other highways. Geo. O. Mitten.

Peoria, Ill.—Sealed bids are asked until 2 p. m., Feb. 1, for paving Washington-st. with brick, requiring 10,052 sq. yds of paving, excavation, stone curb and protection curb. R. W. Schuch, chmn. bd. local impvts.

Canal Dover, O.—Sealed bids are asked until Feb 16 for about 16,500 sq. yds. of brick paving on Factory and Third-sts., and alternate bids on about 10,000 sq. yds. of brick or asphalt block paving on Third-st. B. P. S.; Paul R. Murray, engr., New Philadelphia, O.

CONTRACTS AWARDED.

New Orleans, La.—The contract for constructing Schillinger sidewalks around Lee Circle was awarded, Jan. 11, to Fritz Jahncke.

Cleveland, O.—The Cleveland Trinidad Paving Company was awarded the contract for paving the Brecksville road for $109,000.

West Hoboken, N. J.—Bids were submitted, Jan. 13, for paving Hill and High-sts., by Henry M. Schneider, M. Curley and Callery & Murphy.

Houston, Tex.—The contract for paving Willow-st., San Jacinto and Liberty-aves was awarded, Jan. 13, to Fitzgerald & Ray for $13,000.

Paoli, Ind.—The contract for building 38,548 ft. of gravel roads was awarded, Jan. 5, to E. Stout of Paoli for $14,277.

Lafayette, Ind.—The contract for constructing free gravel roads was awarded, Jan. 11, to Chas. J. Murphy of Brookston, Ind., for $9,724.

St. Louis, Mo.—The contract for paving Chestnut-st., from Broadway to Twentieth, with bituminous macadam was awarded, Jan. 20, to the Granite Bituminous Paving Company for $51,334.50.

Riverside, Cal. — Bids for paving Twelfth-st. were received as follows: H. E. Branch, $6,019; Robert Fitzsimmons, $5,714; Zeno de Moss, $5,790.

Le Mars, Ia.—The contract for brick paving was awarded to Snouffer & Ford of Cedar Rapids, Jan. 18, at $2.02 a sq. yd. for Purington brick.

Indianapolis, Ind.—The contract for building cement walks in Linwood-st., Garfield-ave. and Gladstone-ave., from Washington to Michigan-sts., was awarded, Jan. 20, to J. W. Baxter.

Toledo, O.—The contract for paving has been awarded to H. P. Streicher as follows: Ostrich Lane, $2,138; John-st., $2,602; Prouty-ave., $3.098.

Marion, O.—(Special.)—George E. Dwyer, cy. engr., says that the contract for 12,-

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500 sq. yds. of paving was awarded to Scofield & Fairbanks of Marion.

Decatur, Ind.—Contracts for building 3 miles of gravel roads have been awarded as follows: East Washington road, Julius Haugh, $4,016; Calvin Miller, two West Washington roads, $3,437 and $3,837.

New York City—Bids for asphalt paving for the Manhattan approach of the Williamsburg bridge were submitted Jan. 5 as follows: Barber Asphalt Paving Company, $5,411; Sicilian Asphalt Paving Company, $5,319.

Jeffersonville, Ind.—The contract for furnishing brick for paving the walks outside of the penitentiary was awarded to the Indiana Paving Brick Company at $12 per thousand, and the contract for furnishing curbing to George W. Cox of Osgood at 32 cents per lin. ft.

Crookston, Minn.—P. McDonnell of Duluth was the only bidder Jan. 12 for macadam paving on several streets, as follows: Granite macadam, $1.68 a sq. yd.; granite and sandstone macadam, $1.36; granite curb, $1.25 a lin. ft.; sandstone curb, 78 cents a lin. ft.

Galveston, Tex.—Brown & Dabney of Ft. Worth submitted a bid for paving Market-st. as follows: Vitrified brick on sand base, $1.60 a sq yd.; on concrete base, between street car tracks, $2.30; extra concreting, $6 a cu. yd.; extra filling, 40 cts. a cu. yd.

Columbus, Ind.—Bids were received Jan. 7 for 9,325 sq. yds. of brick paving on Washington-st. and 7,000 sq. yds. on Fifth-st. The contract has not been awarded, however, according to press reports, and the question of asphalt paving for the streets is stated to be under consideration for the streets.

SEWERS.

Bloomington, Ill.—Maps, blue prints, etc., have been secured for the proposed drainage system and construction of a 14-mi. levee along the Illinois river in the Spring Lake district, and work will begin in the spring.

CONTEMPLATED WORK.

Madison, Ill.—A sewerage system is proposed.

Danielson, Conn.—A sewerage system is contemplated.

Putnam, Conn.—The Mayor recommends a sewerage system.

Billings, Mont.—A new sewerage district will be created.

Aberdeen, Wash.—Mayor West urges the necessity of a sewerage system.

of a sewer in the Fourth Ward is $85,000.

Franklin, Ind.—The construction of a sewerage system next summer is contemplated.

Sumpter, Ore.—The construction of a sewerage system is favored by McCalloch.

Piqua, O.—Special—J. A. Miles, clk. of council, says there is some talk of building sewers.

Stamford, Conn.—The construction of a sewerage system is contemplated. Paul Nash, city engr.

Carbondale, Ill.—An ordinance has been passed to build a sewer in Poplar-st. and an alley.

Pittsburg, Pa.—Plans for rebuilding the sewerage system in the downtown district are being prepared.

Eldorado, Kas.—Plans have been completed and bids will be asked for constructing about 5½ miles of sewers.

Springfield, O.—W. H. Selverling, cy. engr., has been directed to prepare plans for a new sewerage system.

Hyattsville, Md.—The Legislature will be asked for authority to issue $30,000 for building a sewerage system.

Brainerd, Minn.—Plans and specifications for a new sewerage system have been prepared by City Engineer Woolman.

Spring Grove, Pa.—The question of issuing $7,000 for building a sewerage system will be voted on in February.

Atchison, Kas.—Plans for the northwest district sewerage system will be prepared by Fred Giddings, cy. engr.

McKeesport, Pa.—A sewer for the Crooked Run district is being considered by council. Thomas W. White, cy. engr.

Youngstown, O.—Petitions have been submitted for building sewers in Glenwood-ave. and Thomas, McGuffey and Foster-sts.

Ensley, Ala.—Sewer bonds have been sold and the work of construction on the proposed sewerage system will begin soon.

Janesville, Wis.—City Engineer Kerch is making plans for a sewerage system which will involve the laying of 6 mis. of pipe.

Los Angeles, Cal.—The immediate construction of a new outfall sewer is recommended by Mayor Snyder in his annual message.

Columbus, Ga.—W. H. Hall, supt. pub. wks., desires information regarding small septic tanks, including plans, estimates, etc.

Denver, Colo.—Means for the disposal of its sewage are being considered by the directors of the State Home for Dependent Children.

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Weehawken, N. J.—The construction of a joint outlet sewer for this place and West Hoboken is approved by the township committee. Clerk Carrol.

Duluth, Minn.—City Engineer Patton estimates the cost of building sewers on Fifty-fourth and Grand aves. and Elinor-st., West Duluth, at $11,239.47.

Guttenberg, N. J.—An ordinance has been approved providing for an 18-in. vitrified pipe sewer on Franklin-ave. and for a sewer in Hudson-boulevard.

Muskegon, Mich.—A sewerage system will be constructed in the southeastern part of the city after plans prepared by George S. Pierson of Kalamazoo.

Macon, Ga.—Plans for a sewerage system for Vineville, Pleasant Hill and Huguenin Heights have been submitted by J. W. Wilcox, cy. engr.

Little Rock, Ark.—Special — Gerhard Morgner, supt. pub. wks., says the construction of sewer extensions is talked of but nothing is assured yet.

Kansas City, Mo.—The bd. of pub. wks. approved Jan. 18 the plans prepared by Cy. Eng. Pike for the proposed intercepting sewer to drain O. K. creek.

New York City—A petition has been submitted to Congress for an appropriation of $1,250,000 for improvements to Ellis Island, which include the construction of a new sewerage system.

South Orange, N. J.—Bids for furnishing materials and constructing section 4 and 5 of the proposed lateral sewers will be received after the bonds are disposed of. S. H. Rollinson, cham. com.

Northampton, Mass.—Bids for the construction of main sewers through the Meadows into Connecticut River, at a cost of about $100,000, will be asked for as soon as the land question at the outlet is settled.

Galesburg, Ill.—The estimated cost of constructing the sewerage system and purification works is as follows: Main interceptor, $302,425; Fulton-st. branch, $ 8-688; Railroad Creek branch, $43,538; N. Henderson-st. branch, $44,438; N. West-st. branch, $56,550; Main-st. branch, $9,706, purification works, $43,000.

Reading, Pa.—In his annual message, Mayor Yeager recommends the construction of a storm water sewer in Franklin-st., the construction of sewers in Rose Valley Creek and Canal and Windsor-sts., extension of present house sewer system, reconstruction and installation of sewage disposal plant to meet not only present but all future needs.

CONTRACTS TO BE LET.

Glencoe, Minn.—Bids are asked until Feb. 5 for constructing ditches Nos. 3 and 4. F. D. Stocking, co. audt.

Alexandria, Minn.—Bids are asked until March 7 for constructing ditch No. 3 and branches. E. P. Wright, co. audt.

Center City, Minn.—Bids are asked until April 22 for constructing ditches Nos. 3 and 4. A. B. Slattengren, co. audt.

Berwick, Pa.—Sealed bids are asked until Feb. 4 for constructing brick and pipe sewers. J. N. Harry, chmn. st. com.

Rosedale, Kas.—Sealed bids are asked until 5 p. m. Feb. 4 for building sewers on Oak-st. and Rosedale-ave. Geo. Gerner, cy. clk.

St. Paul, Minn.—Sealed bids are asked until Feb. 2 for constructing a sewer system at Ft. Snelling. R. M. Schofield, const. Q. M.

Washington, D. C.—Sealed bids are asked until Feb. 20 for constructing sewers in the District of Columbia. H. B. F. MacFarland, chmn. district comrs.

New Orleans, La.—Sealed bids are asked until Feb. 2 for constructing 66 miles of sewers and appurtenances. F. S. Shields, secy. sewerage and water bd.

Scranton, Pa.—Sealed bids are asked until 2 p. m. Feb. 4 for constructing sewers in sections "E," "G" and "H" of the Nineteenth Ward. B. T. Jayne, dir. dept. pub. wks.

Washington, D. C.—Bids are asked until March 5 for erecting sewerage screens, machinery and apparatus at sewerage pumping station. H. B. F. MacFarland, chmn. dist. comrs.

Santiago, Chile—Public bids will be opened July 1 for constructing sewerage. Address Chilean Legation, Washington, D. C., or Chilean Consulate-General, 135 W. Eleventh-st., N. Y. City.

Saginaw, Mich.—Sealed bids are asked until 7:30 p. m. Feb. 11 for furnishing Portland and natural cement, drain tile, sewer pipe, sewer basin and sewer and water manhole castings. W. H. Barton, clk. B. P. W.

Findlay, O.—Bids are asked until Feb. 2 for constructing combined local sewer No. 2 on W. Front-st., including manholes, flush tanks and catch-basins; also a sewer in E. Lincoln-st. Frank C. Ray, clk.

Vailsburgh, N. J.—Sealed bids are asked until Feb. 10 for 2,981 ft. 12-in., 11,000 ft. 10-in. and 27,863 ft. 8-in. pipe sewers, 122 manholes, 32 flushtanks and 4,000 cu. yds. rock excavation. John Henry Theberath, acting mayor; Andrew R. Fitzsimons, clk.; Eugene Murray, ch. engr.

Buffalo, N. Y.—Bids will be received Feb. 2 for furnishing and erecting 3 horizontal centrifugal sewage pumps, 3 engines and auxiliary machinery to drive them and 4 125-HP boilers with auxiliaries for a sewage pumping plant on Main and Hamburg Canal strip near Hamburg-st. Francis G. Ward, comr. pub. wks.

CONTRACTS AWARDED.

Joplin, Mo.—The contract for a sewer was awarded to J. F. McCarthy for $6,000.

St. Paul, Minn.—The contract for building the St. Anthony Park sewer has been awarded to E. J. Kirkland for $50,122.99.

Seattle, Wash.—T. I. Peterson secured the contracts for sewer systems in the Brooklyn and Latonia districts for $58,-050.

Grand Junction, Colo.—The contract for constructing a sewerage system at the Teller Indian Institute was awarded to D. J. Tirsway of Denver for $16,000 to $17,000.

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Lancaster, Pa.—Contracts for building two sewers have been awarded to Stone, Jordan & Co., Philadelphia, for $180,000.

Clinton, Ia.—The contract for constructing a sewer in Pearl-st. was awarded to George M. King of Des Moines for $6,895.

Mishawaka, Ind.—The contract for constructing the W. Joseph-st. sewer was awarded to the Elkhart Construction Co. of Elkhart, Ind.

Vinita, Ind. Ter.—The contract for constructing a sewerage system was awarded Jan. 5 to the Allan Black Co. of St. Paul for $18,500.

Youngstown, O.—Sherman De Groodt secured the contract for a sewer on W. Federal-st. and Rochford & Comisky for a sewer on E. Woodland-ave.

Delray, Mich.—The contract for building a sewer in McGregor-ave. was awarded to the Elkhart Construction Co. of Elkhart, Ind., for $23,000.

Athens, Ala.—The Nashville Plumbing Co. of Nashville, Tenn., was awarded the contract Jan. 14 for constructing a sewerage system here for $11,736.

Los Angeles, Cal.—The contract for furnishing 20,000,000 brick for the outfall sewer and storm drains was awarded Jan. 19 to Charles Forrester at $6.40 per thousand.

Niagara Falls, N. Y.—The contract for extending the tunnel trunk sewer in the eastern part of this city has been awarded to James D. Casey of Rochester for about $90,000.

Petaluma, Cal.—Special—N. S. Frost, cy. engr., says the contract for a 6-in. pipe sewer on Tifft-st. was awarded to J. R. Nesbitt at 50 cents a lin. ft. and $1.50 for lampholes.

Buffalo, N. Y.—Bids were submitted, Jan. 19, on three sewers as follows: Hertel-ave., Miller & Franklin, $18,900; Angle and Heath-sts., C. G. Steinwocks, $7,590; Merrimac-st., H. P. Burgard, $6,000.

Toledo, O.—Sewer contracts have been awarded as follows: No. 910 in Western-ave., John McMahon, $2,011.80; No. 920 in an alley, John McMahon, $1,478.88; No. 917 in alley, A. Lewandoski, $823.

Boston, Mass.—Contracts for the construction of high level sewers were awarded, Jan. 5, as follows: Talbot-ave., circular brick sewer, section 2, Coleman Bros., $14,882.50; section 3, Coleman Bros., $13,987. Dorchester high level circular brick sewer, section 1, D. F. O'Connell, $14,176.95; section 2, H. A. Hanscom Company, $12,042.20.

Beaver Falls, Pa.—Bids were submitted,

WATER-WORKS.

Bloomfield, N. J.—This borough voted, Jan. 19, to purchase the plant of the Orange Water Company for $90,000.

Marquette, Mich.—The Federal Trust Company of Boston has applied for a receiver for the Ironwood Water Company on the ground of wasteful management.

New Cumberland, Pa.—The Fairview Township Water Company has been incorporated to supply water for this place by T. Russ, J. Reiff and George H. Reiff.

Winthrop Harbor, Ill.—The Winthrop Harbor Water and Supply Company has been incorporated to construct water works, light, heat and power plants by G. A. Truesdale, R. R. Cowie and S. M. Swanson.

CONTEMPLATED WORK.

Saugatuck, Mich.—Plans are being prepared for a new water works system.

Toledo, O.—A submerged 20-in. water main across the Maumee River is proposed.

Cotter, Ark.—A company has been formed to establish and operate a water works system.

Mayfield, Cal.—Bids will probably not be received for constructing water works before April.

Pawtucket, R. I.—The purchase of a new pumping engine is contemplated. S. H. Roberts, cy. clk.

Pittsburg, Pa.—The compulsory installation of water meters is recommended by Dir. E. M. Bigelow.

Holyoke, Mass.—The purchase of a large meter to be placed at the source of water supply is proposed.

Waltham, Mass.—Le Roy Brown, supt. w. w., favors replacing 9 mls. of cement mains with cast-iron pipes.

Salt Lake City, Utah—The establishment of a permanent water supply is urged by the Commercial Club.

Montreal, Que.—Plans are being made for a complete filtration system for the Montreal Water and Power Company.

Barberton, O.—Plans and specifications for the proposed new water works system have been approved.

Canton, O.—(Special.)—Phil H. Weber, cy. engr., says a new pumping station, a 12,000,000 gal. pump and three 200- hp. boilers.

Delhi, O.—A water works system to supply this town. Home City, Fernbank, Addyston, North Bend and Cleves is contemplated.

Newark, N. J.—The estimated cost of an auxiliary water main from Campbell's Pond to this city is $100,000 or $123,000.

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Philadelphia, Pa.—The names of firms manufacturing gas and water pipe are desired by Samuel P. Yoe, C. E., 1861 Frankford-ave.

Ludington, Mich.—The bd. of pub. wks. has asked the City Council to call a special election to vote on the improvement of the water works system by extending the intake pipe 1,000 ft. further into the lake.

Shenandoah, Pa.—The question of increasing the borough debt $50,000 for securing a more plentiful water supply will be voted on in February.

Evansville, Ind.—The estimated cost of repairing the damage caused at the new water works by the breaking of the intake pipe is $50,000 to $100,000.

Cambridge, Mass.—The water board has asked for an appropriation of $500,000 for constructing a new main from Hobbs Brook basin to Fresh Pond. E. C. Brooks, supt. w. w.

Pittston, Pa.—The stockholders of the Monongahela Water Company voted to increase its capital stock for the construction of new pipe line extensions, boiler, tanks, pumping machinery and other permanent improvements.

The construction of water works systems is contemplated at the following places: Hampton, Neb.; Kensington, Minn.; Maiden Rock, Wis.; Prattsville, N. Y.; Chambersburg, Pa.; Ashtabula, O.; Glendale, Wash.; Mt. Jackson, Va; Adams, Ore.

Springfield, O.—A resolution has been adopted by the B. P. S. to ask for bids for engaging a hydraulic engineer to prepare plans and specifications for the purchase of a 10,000,000 gallon pumping engine and all necessary equipment.

St. Paul, Minn. — In his annual report City Engineer Rundlett recommends the improvement of Vadnais and Pleasant lakes by the construction of a deep well, 2,400-foot enclosed conduit between Vadnais and Pleasant lakes and the protection of the shores of Centerville Lake.

Monaca, Pa.—Council decided, Jan. 13, to ask the Secretary of War for permission for this borough to erect a crib in the Ohio River in front of the pumping station for the purpose of improving the water supply and protecting the pumping station.

Washington, D. C.—The colonial government of the island of Bermuda is investigating the question of a pure water supply for the citizens of that island, and has called upon the experts of the United States Geological Survey to furnish information regarding the possibility of finding a large and continuous supply of fresh water by sinking artesian wells.

CONTRACTS TO BE LET.

Jacksonville, Ill.—Bids are asked until Feb. 10 for a pumping plant. Merdosia Lake, Drainage and Levee Dist.

Santa Barbara, Cal.—Bids will be received until Feb. 23 for constructing a tunnel 19,560 ft. long. Comrs. W. W. dept.

New Orleans, La.—Sealed bids are asked until Feb. 2 for laying 2.7 mls. of water mains. F. S. Shields, secy. sewerage and water bd.

Dalles City, Ore.—Sealed bids are asked until Feb. 10 for constructing a water works system. T. J. Seubert, prest. water comrs.

St. Paul, Minn.—Sealed bids are asked until 11 a. m. Feb. 2 for constructing a water system at Fort Snelling. R. M. Schoffield, Const. Q. M.

St. Louis, Mo.—Sealed bids are asked until Feb. 18 for a 150,000 gal. steel tank with trestle at Jefferson Barracks. Maj. Thomas Cruse, Depot Q. M.

Ligonier, Ind.—Sealed bids are asked until March 9 for improvements to the water works system. Fred H. Green, mayor; H. Jeanneret, cy. clk.

Kansas City, Mo.—Bids will be received until March 9 for improvements to the 48-in. steel water flow line from Kaw Point to Turkey creek. B. P. W.

Saginaw, Mich.—Sealed bids are asked until Feb. 11 for furnishing the cast iron water pipe and special castings required during the year. W. H. Barton, clk. B. P. W.

Oil City, Pa.—Sealed bids are asked until Feb. 15 for 1 triple expansion condensing crank and flywheel pumping engine of 3,500,000 gals. P. C. Porter, clk. bd comrs. water and light.

Milwaukee, Wis.—Sealed bids are asked until Feb. 1 for furnishing a pumping engine, boilers and auxiliary machinery for the Kinnickinnick river flushing tunnel. Chas. J. Poetsch, chmn. B. P. W.

Santiago, Chile.—Public bids are asked until July 1 for improving the water supply of this city. Address Chilean Legation, Washington, D. C., or Chilean Consulate-General, 135 W. Eleventh-st., New York City.

Cienfuegos, Cuba—Bids are asked until April 2 for furnishing material for the water works as follows: 10,441 ft. c. i. pipe, 185 tons special castings, 279 valves, 130 hydrants, 345 tons structural steel, 11,135 sq. yds. expanded metal, 330,000 lbs. lead. C. C. Vermeule, cons. engr., 203 Broadway, New York City; F. W. Bennett, ch. engr., San Carlos 128, Cienfuegos.

CONTRACTS AWARDED.

Kansas City, Mo.—The contract for a pumping engine for Quindaro Station was awarded to the Allis-Chalmers Company for $79,400.

Peoria, Ill.—The contract for piping the new water system of the Bartonville asylum was awarded to Charles O'Neill & Sons for $3,600.

Vinita, Ind. Ter.—The contract for constructing a water works system was awarded to Allen, Black & Co. of Minneapolis, Minn., for $73,455.

Shawnee, Okla.—The contract for a new water works system was awarded to Henry C. Ulen, jr., of Oklahoma City for $122,000.

Port Angeles, Wash.—H. A. Lengenbrink of St. Louis, Mo., has been granted a

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50-year franchise for water and power privileges in this city.

La Crosse, Wis.—The contract for installing new boilers at the pump house was awarded to F. Freeman Sons & Co. of Racine for $9,484.

Heflin, Ala.—A franchise has been granted to F. F. Taylor and W. B. Merrill for constructing and maintaining a water works and electric light plant.

Danville, Va.—The contract for constructing the new intakes for the new municipal pumping station was awarded, Jan. 8, to Charles Orchard for about $3,000.

Kansas City, Mo.—The contract for constructing a submerged pipe line under the Kaw river was awarded, Jan. 18, to Kahmann & McMurry of this city for $24,000.

Salt Lake City, Utah—The contract for water mains and sewer work during 1904 was awarded to James Kennedy & Co. of Fargo, N. D., for $24,486 and $20,301, respectively.

St. Paul, Minn.—Contracts for laying a main in W. Seventh-st. were awarded, Jan. 11, as follows: Laying main, P. H. Thornton, $1.39 a ft.; furnishing pipe, Dinwick Pipe Company of Birmingham, Ala.; $23.35 per ton; hauling, Charles Forrestal & Co.; valves and service boxes, Crane & Ordway, $2,000; special castings, hydrants and cast iron pipe, South Park Foundry and Machine Company.

Dayton, O.—Bids were submitted Jan. 19 for furnishing ⅝-in. water meters to this city. Henry W. Worthington of New York City furnished the lowest bid at $5.60 each. The Pittsburg Meter Company, which has been furnishing the city with meters at $6.50 each, bid $6.25. The bids were as follows:

Union Meter Company, Worcester, Mass.—⅝-in. meters, $6.10 each; ¾, $10.90; 1-in., $19.15; 1½, $29.65; 2-in., $44.90.

M. J. Gibbons, Dayton—⅝, $6.45; ¾, $9.45; 1-in., $12.50; 1½-in., $24; 2-in., $30.

Pittsburg Meter Company, Pittsburg, Pa.—⅝, $6.25; ¾, $11.30; 1-in., $15.30; 1½, $27; 2-in., $45.

Hersey Manufacturing Company, Boston—⅝, $8; ¾, $12; 1-in., $16; 1½, $30; 2-in., $50.

Neptune Meter Company, New York City—⅝, $8.40; ¾, $12.50; 1-in., $16.75; 1½, $35; 2-in., $55.

Henry R. Worthington, New York City—⅝, $5.60; ¾, $9; 1-in., $13; 1½, $25.

National Meter Company, New York City—⅝, $10.40; ¾, $15.60; 1-in., $20.80; 1½, $40; 2-in., $60.

The Buffalo Meter Company of Buffalo, N. Y., bid on bulk lots as follows: 800 (⅝-in. meters), $6,809.40; 20 (¾-in. meters), $5,148.90.

BRIDGES.

Linden, Tenn.—The county court has [illegible] bridges across Buffalo

23, according to press reports, for building a bridge.

Los Angeles, Cal.—Plans have been submitted for constructing three bridges across the Los Angeles river.

Boonville, Ind.—Bids are asked until March 7 for constructing an iron bridge. R. D. O. Moore, co. audt.

Iowa City, Ia.—Plans and specifications are being prepared for a proposed concrete viaduct on Iowa-ave.

Portland, Ore.—Bids are asked until Feb. 19 for a steel bridge at Thurman-st. Thos. C. Devlin, cy. audt.

Kansas City, Kas.—Sealed bids are asked until 12 m. Feb. 1 for building two steel bridges. Frank Holcomb, co. clk.

Cohoes, N. Y.—Plans have been prepared by City Engineer Van Auken for a bridge across the western branch of the Mohawk.

Fargo, N. D.—A bill has been introduced asking for authority to build a bridge across the Missouri river at this place.

Richmond, Ind.—City Engineer Weber has submitted several different plans for the proposer South Side bridge.

Oshkosh, Wis.—Plans are being considered for building a new bridge to replace the one now crossing the river at Main-st.

Dillon, Mont.—Bids are asked until Feb. 15 for constructing a bridge across Big Hole river at Melrose. W. M. Oliver, chmn. co. comrs.

Somerset, Ky.—The county court has decided to build a modern steel bridge over the south fork of Cumberland river at Burnside.

Neosho, Mo.—Bids are asked until Feb. 5 for two bridges, one across Shoal creek and one across Capps creek. R. Fred Jones, rd. and br. comr.

Crookston, Minn.—The county commissioners decided, Jan. 9, to build a new steel arch bridge across Red river, on Robert-st., in this city.

Redding, Cal.—The contract for the big brick bridge over Calaboose creek, at Yuba-st., was awarded to Frank Thompson and Chris Stabler, for $628.

Fall River, Mass.—A bill has been introduced appropriating $100,000 for building a bridge across the Seaconnet river, between Tiverton and Portsmouth.

Walpole, N. H.—The question of erecting a bridge over the Connecticut river, between North Walpole and Bellows Falls, is being discussed by the selectmen.

South Bend, Ind.—The contract for erecting a 700-ft. bridge across St. Joe river was awarded to the Lafayette Engineering Company of Lafayette for $79.-200.

Dayton, O.—Special—F. M. Turner, cy. engr., says that the contract for the Third-st. bridge was awarded to Charles H. Hoglen of this city.

Houston, Tex.—Sealed bids are asked [illegible]

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the substructure for a new bridge on Evan-st. over Erie Canal. Francis G. Ward, comrs. pub. wks.

Kankakee, Ill.—Plans have been accepted, according to press reports, for a concrete steel bridge across Kankakee river at Washington-st. J. E. Smith, chmn. com. pub. wks.

Bloomfield, Ind.—Bids are asked until Feb. 2 for constructing iron bridges in Jackson, Taylor and Stockton twps., and stone arches in Richland and Washington twps. Co. comrs.

Beaufort, S. C.—The county comrs. will call for bids, according to press reports, to be received at April term of court, for building bridges over Coosawhatchie river and Bee's creek.

Atlanta, Ga.—A steel bridge will be constructed soon across the Chattahoochee river at the Mason and Turner Ferry, about nine miles from this city. Judge E. B. Rosser, chmn. com. on rds. and bridges.

Washington, D. C.—Sealed bids are asked until Feb. 16 for constructing a 7-span masonry bridge across the Rock Creek Valley, on the line of Connecticut-ave. H. B. F. MacFarland, chmn. Dist. Comrs.

Lyndon, Kas.—Bids are asked until Feb. 2 for constructing superstructure and reconstructing abutments and two piers for Wilden bridge over Marais des Cygnes River. Chas. F. Hobbs, co. clk.

Buffalo, N. Y.—Special.—The D., L. & W. R. R. Co. has made application to the canal board of the state of New York for permission to elevate its track and to construct a stationary bridge over the Ohio Basin slip.

Kansas City, Mo.—An ordinance was passed Jan. 18 authorizing the city engineer to prepare plans and specifications for an overhead viaduct and approaches to and over the tracks of the Kansas City Belt Line Railway Company on Broadway.

Cincinnati, O.—Sealed bids are asked until Feb. 6 for substructure and approaches to bridge over Jordan creek on Jordan creek road; substructure of bridge across Great Miami river at Elizabethtown; superstructure of Elizabethtown bridge. E. L. Lewis, co. audt.

Everett, Wash.—Cy. Engr. Barkhuff received word from the War Department, Jan. 13, stating that this city may proceed with the construction of the proposed new bridge over the Snobhomish river, according to the plans submitted.

PARKS.

South Haven, Mich.—This village voted to issue bonds for a new city park.

Topeka, Kas. — This city will expend

Peoria, Ill.—The park board is considering an offer that has been made it for establishing a park on the river front. B. F. Cartwright, secy.

New York City—A large park has been dedicated to this city by James Gordon Bennett. It lies between the boulevard, Lafayette and Broadway, north of One Hundred and Eighty-second-st.

Baltimore, Md. — City Solicitor Bruce will prepare a separate act for the proposed boulevard connecting the parks of this city.

STREET LIGHTING.

Topeka, Kas.—Improvements to the electric light plant are contemplated.

Cripple Creek, Colo.—Mayor Shockey advises the erection of an electric light plant.

Newport, Ky.—Mayor Helmbold advocates municipal ownership of an electric light plant.

Churchville, N. Y.—The contract for street lighting has been awarded to William Kates.

Tallahassee, Fla.—This city voted to issue bonds for enlarging the electric light plant.

Canton, Mo.—Bids are asked until Feb. 3 for constructing an electric light plant. Town clk.

Conyers, Ga.—This city has voted to issue $10,000 bonds for constructing an electric light plant.

Pittsburg, Pa. — An ordinance was passed Jan. 11 authorizing a contract for street lighting for 1904.

Hannibal, Mo.—This city voted Jan. 11 to issue $100,000 bonds for constructing an electric light plant.

Winston-Salem, N. C.—W. T. Brown has been appointed to investigate the feasibility of an electric light plant.

Shell Lake, Wis.—This town voted Jan. 12 to borrow $10,000 to establish and equip an electric light plant.

Oconomowoc, Wis.—The committee on electric lighting is considering four plans for improving the electric light plant.

Savannah, Ga.—In his annual report the director of public works recommends municipal ownership of an electric light plant.

Ft. Wayne, Ind.—Messrs. Schnitker and Clark of the town of New Haven are agitating the question of an electric light plant.

Geneseo, Ill.—The City Council voted Jan. 21 to cancel the contract with the Electric Light Company for lighting the streets.

Lockport, N. Y.—The office, test-room and pipe-room of the Lockport Gas and Electric Light Company were wrecked by an explosion Jan. 8.

Columbus, Ind.—The contract for a new electrical light plant was awarded to the

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Omaha, Neb.—This city is considering a proposition of the electric light company to replace 383 gasoline lamps now in use with 32-c. p. incandescent lamps.

Braddock, Pa.—The borough council adopted a resolution, Jan. 4, providng for the appointment of a committee to inquire into the cost of an electric light plant.

Buffalo, N. Y.—Sealed bids are asked until Feb. 3 for electric work to be done at the Buffalo State Hospital. Carroll F. Smith, acting sec'y. State Comn. in Lunacy.

Lansing, Mich.—The question of granting a franchise for the operation of a heating and electrical power plant to John H. Chase and William L. Haag will be voted on Feb. 1.

Cheyenne, Wyo.—Sealed bids are asked until Feb. 13 for wiring buildings and grounds, installing fixtures, arc lights, etc., at post of Fort D. A. Russell, Wyo. Capt. W. S. Scott, Q. M.

Eau Claire, Wis.—The Trades and Labor Council adopted a resolution Jan. 14 against awarding the city lighting contract to the Eau Claire Light and Power Company, and in favor of municipal ownership of a light plant.

Beaver, Pa.—The citizens have appointed John H. Eaton chairman and Aaron B. McGrew secretary of a committee to take action regarding the formation of a corporation to furnish electric light for the streets and houses.

Alhambra, Cal.—Sealed bids are asked until Feb. 9 for a franchise to erect poles, string wires and construct underground conduits, and to maintain and operate same for 50 years for transmitting electricity for light, heat and power. A. A. Clapp, Sr., cy. clk.

Buffalo, N. Y.—(Special.)—Mayor Knight has signed the contract passed by the city council awarding to the Buffalo Gas Company the contract to light the city for 5 years, as follows: 1st yr., 79 cts. per 1,000; 2nd yr., 78 cts.; 3rd yr., 77 cts.; 4th yr., 76 cts.; 5th yr., 75 cts. The city may use such burners and lamp heads as desired, and also pay gas company for lighting and extinguishing and cleaning, 17 cts. per lamp per month.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Harrisburg, Pa.—The contract for collecting garbage for 10 years was awarded to the Harrisburg Sanitary Co. at $28,080 per year.

Marion, O.—(Special.)—George E. Dwyer, city engineer, says the city council and B. P. S. will build a garbage disposal plant this summer.

St. Louis, Mo.—J. A. Worthington represents a Denver syndicate which has 1904 was awarded to the Indianapolis Street Sweeping Co. at 13.9 cts. per 10,000 sq. ft. for each sweeping.

Buffalo, N. Y.—(Special.)—Mayor Knight has signed the resolution passed by the common council to enter into a contract with the Buffalo Sanitary Co. for cleaning the streets of this city for five years for $450,000.

Grand Rapids, Mich.—A council committee has been appointed to investigate a report on the advisability of a municipal system of garbage collection. Secretary Brown of the board of health has sent letters to 21 cities asking for information.

Philadelphia, Pa.—The contracts for cleaning the city streets this year were awarded to E. H. Vare, Daniel Dooley, J. H. Hinckle & Co., David McMahon and Daniel J. McMahon. Under these contracts the city will pay $292.43 a mile more for street cleaning than it paid last year.

FIRE APPARATUS.

Kensington, Minn.—The purchase of a chemical fire engine is proposed.

Rochester, Minn. — The purchase of a chemical fire extinguisher for the county poor farm is proposed.

Ashland, Wis. — Bids are asked until Feb. 5 for a hose wagon and 2,000 feet of hose. W. W. Fisher, cy. clk

Piqua, O.—(Special.)—J. A. Miles, clerk of Council, says the Central Fire Department and the sub-station is contemplated.

East Grand Fork, Minn.—Bids are asked, until 8 p. m., Feb 2, for 1,000 ft of wax and gum-treated lined cotton fire hose. E. R. Jacobi, City Recorder.

Belleville, N. J. — The Board of Fire Commissioners is considering the installation, maintenance and operation of a Gamewell fire alarm system.

TOO LATE FOR CLASSIFICATION

Toledo, O.—Resolutions were approved Jan. 20 for repaving eleven streets.

Belleville, Ill.—The Commercial Club is in favor of paving the public square.

Kansas City, Mo.—The property-owners on McGee-st., from Eighth to Admiral boulevard, have petitioned for granite block paving.

Hancock, Mich.—The extension of the asphalt pavement on Quincy-st. about four or five blocks is contemplated for this spring.

Mexico, Mo.—About nine blocks of vitrified brick or block paving in the business section of this city is contemplated.

Ogden City, Utah.—A resolution has been adopted to repave Twenty-fifth-st., from Washington to Wall-aves., with asphalt. W. J. Critchlow, cy. recorder.

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MUNICIPAL ENGINEERING

VOLUME XXVI MARCH, NINETEEN HUNDRED FOUR NUNBER THREE

THE CEMENT SITUATION.

The data gathered for the third edition of the "Directory of American Cement Industries" now in press and to be issued shortly, show conclusively the healthy condition of the cement trade and the good prospects for further rapid development, provided financial and labor troubles do not delay investment in construction of the many public and private works which are now necessary or will be in the near future.

The invasion of new fields of construction and the more thorough covering of the old ones by cement promise some years of increase in the demand which will tax the facilities of the existing companies and encourage the formation of new ones. The following tables will give a birdseye view of the past and a basis for some idea of what the immediate future will be.

The first table gives the number of works, the product in barrels and the value of the cement in bulk for each year since 1895. The figures for 1903 are estimates. The 63 in the column of "No. of Works" is the number of the companies manufacturing cement, and to be on the same basis as the other figures in the column should be increased by the number of plants operated by companies in addition to their original plans. This does not affect the total production, but explains the discrepancy in number of plants. The product for 1903 is estimated at 1,000,000 barrels higher than the estimate made in February, 1903, and is probably as conservative as the estimates made in the article on page 83 of Municipal Engineering of that date. The great fluctuation in prices in 1903 makes the assumption of an average price of bulk cement at the mill difficult. That assumed, $1.10 a barrel, may differ from the official report, as that may be influenced by the date the reports are made.

PRODUCTION AND VALUE OF PORTLAND CEMENT IN THE UNITED STATES.

Year.	No. of Works.	Product. Barrels.	Value.
1895.....	22	990,324	$1,586,880
1896.....	26	1,543,023	2,424,012
1897.....	29	2,677,775	4,315,891
1898.....	31	3,692,284	5,970,773
1899.....	36	5,652,266	8,074,371
1900.....	50	8,482,020	9,280,525
1901.....	56	12,711,225	12,532,360
1902.....	68	17,230,644	20,684,078
1903.....	*63	!20,700,000	!22,770,000

*Number of manufacturing companies.
!Estimated.

At the close of 1903 there were 68 different companies manufacturing Portland cement in the United States, the number of works at different locations on the basis of the U. S. Geological Survey reports being larger by some 6 or 8. The maximum capacity of these companies, as taken from their reports to the Directory, assuming 300 days as the length of the operating year, was 40,000,000 barrels a year. The estimated production of these companies was almost exactly half this capacity. Comparison of reported figures for 1903 shows very nearly the same relation of capacity and actual production. There are several reasons for the difference. Few plants can operate all their machinery fully 300 days a year. Many sections of plants have recently been thrown out of use for considerable periods to make changes in machinery or its arrangement or for the purpose of enlargement. Some companies have been in financial difficulties from faults of management or otherwise. Some have had difficulty in disposing of their product on account of local overstocking of market, defective quality, etc. Some give the maximum capacity under forced speed which cannot be maintained continuously. The labor troubles, as last year, cause general overstocking. The

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sum of these effects cuts down the total production to about half the capacity.

The reports indicate that there will be 8 or 10 new mills put in operation during 1904, which will increase the capacity some 10 or 12 per cent. The average capacity of the mills in operation is not quite 2,000 barrels a day. The average production, with figures for former years for comparison, is given in the following table:

AVERAGE PRODUCT PER MILL AND VALUE OF PORTLAND CEMENT.

Year.	Av. Product of Each Mill Brls. a Day.	Av. Value at Mill Per Brl.
1895	150	$1 60
1896	197	1 57
1897	308	1 61
1898	397	1 62
1899	523	1 43
1900	565	1 09
1901	757	0 99
1902	912	1 21
1903	*958	*1 10

*Estimated.

For 1903 the average product is per company; that per mill would probably be about 900 barrels. The limit of increase in production per mill seems to be very nearly reached. The average capacity of the mills likely to go into operation in 1904 is perhaps 100 barrels a day less than the average of those now in operation, and the average production per mill, unless there is a great demand for cement in 1904 to crowd the mills, will not be greater than in 1903.

There are very many companies listed in the Directory of American Cement Industries as projected, some being under construction. There are about thirty-five of these which state the proposed capacity of their mills, and, if constructed they would increase the total capacity of mills about 40 per cent. Very few, if any, of these will be completed in 1904 and but few more in 1905. Judging from the list of discontinued names of cement companies given in the directory, many of them will fall by the wayside. Some of the most promising projects have not yet been put into official form and therefore do not appear in the lists.

The following table gives the data regarding the actual consumption of cement in the United States. The figures for imported cement have been corrected for the years 1900 to 1902, deducting the amount of cement re-exported from the total domestic consumption and not the production and importation. Assuming the consumption of domestic Portland cement to be 20,400,000 barrels in 1903, it will be seen that the increase in the use of domestic Portland cement has been very nearly 4,000,000 barrels each year since 1900. The increase in capacity by addition of new mills for 1904 is but little more than four million barrels and the actual production will be somewhat less. The new works will therefore scarcely be able to take care of the increase if it is equal in amount to that of the recent years.

TOTAL CONSUMPTION OF CEMENT IN THE UNITED STATES.

Year.	Natural.	Imported.	Domestic Portland.	Puzzolan.
To 1880	54,970,000	793,281	82,000	.....
1880	2,030,000	187,000	42,000	.....
1881	2,440,000	221,000	60,000	.....
1882	3,165,000	370,406	85,000	.....
1883	4,190,000	486,418	90,000	.....
1884	4,000,000	585,768	100,000	.....
1885	4,100,000	554,396	150,000	.....
1886	4,186,152	650,032	150,000	.....
1887	6,692,744	1,070,400	250,000	.....
1888	6,253,295	1,835,504	250,000	.....
1889	6,331,876	1,740,356	300,000	.....
1890	7,082,204	1,940,186	335,000	.....
1891	7,451,535	2,988,313	454,813	.....
1892	8,211,181	2,440,654	547,440	.....
1893	7,411,815	2,674,149	590,652	.....
1894	7,563,488	2,638,107	798,757	.....
1895	7,741,077	2,997,395	990,324	.....
1896	7,970,450	2,989,597	1,543,023	.....
1897	8,311,688	2,090,924	2,677,775	.....
1898	8,418,924	2,043,818	3,692,284	.....
1899	9,868,179	2,108,388	5,652,266	233,000
1900	8,383,519	2,386,683	8,482,020	365,611
1901	7,084,823	893,445	12,337,291	272,689
1902	8,044,305	1,926,704	16,889,823	478,555
1903	†7,000,000	2,017,303	†20,400,000	†600,000

†Estimated.

The increase in the amount of imported, natural and puzzolan cements from 1901 to 1902 is about 2,200,000 barrels, of which 1,000,000 barrels is in foreign cements. The increase in use of domestic Portland cements from 1901 to 1902 of 4,500,000 barrels, shows a total increase in cement consumption of 6,700,000 barrels and indicates the inability of the domestic plants to meet all the demands in 1902.

The estimated increase in domestic use of domestic Portland cement from 1902 to 1903 is a little less than 4,000,000 barrels. The actual domestic consumption of foreign cements was practically the same as in 1902. The figures for consumption of natural cement are not available, but expert estimates of one district indicate that the production for 1903 was

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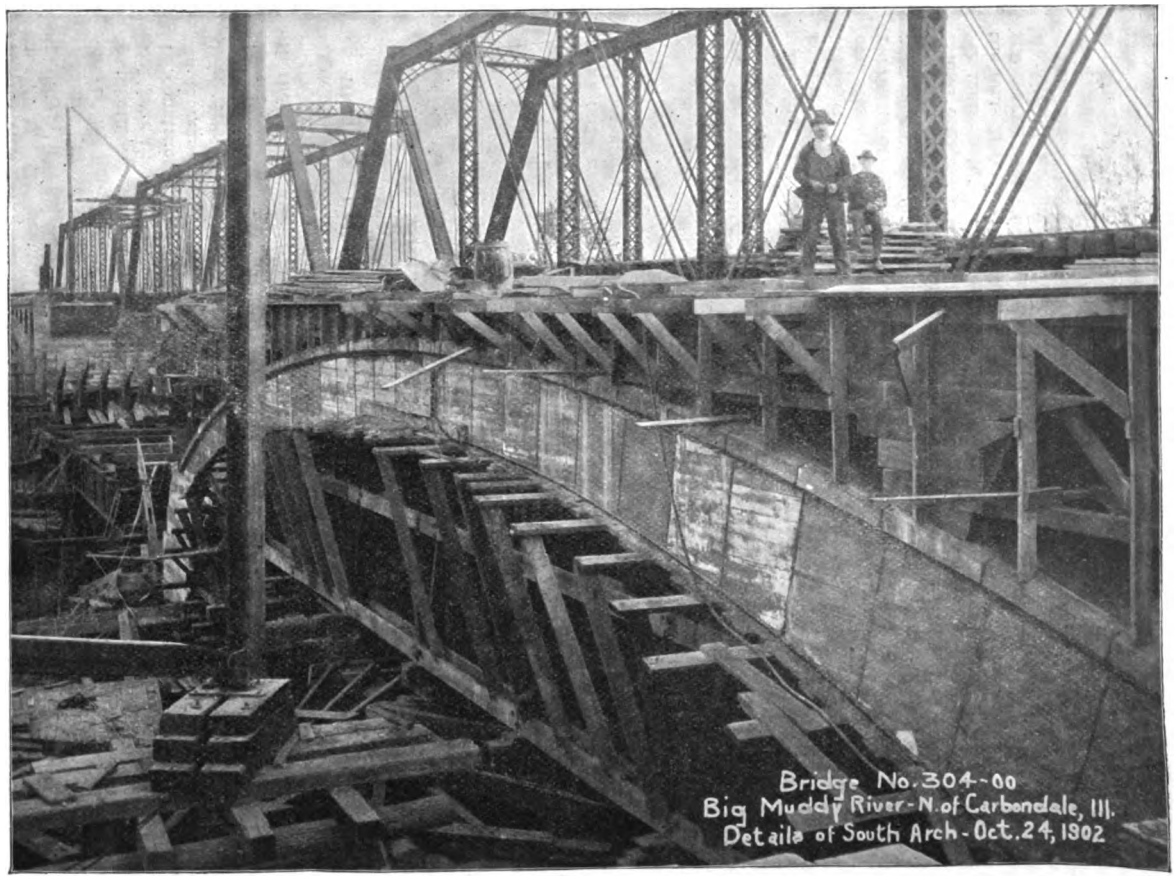

I. BIG MUDDY CONCRETE BRIDGE, ILLINOIS CENTRAL RAILROAD,
Showing Main Arch Voussoirs and Part of Centering and Molds for Spandrel Arches.

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bor and financial troubles on the one hand, or by concerted restriction in production on the other, it seems probable that the plants in operation in 1904 will be practically equal to the demands made upon them. An increase in demand beyond that estimated is probable under favorable conditions and must be met, if it occurs, by importation largely. A decrease in demand, on account of decrease in construction, must be met by a restriction of production. Although this is a presidential year the prospects for a good season in construction lines are excellent, and an increase in demand is more probable than a decrease.

The following table gives the increase in the consumption of cement per capita in the United States:

CONSUMPTION OF CEMENT IN UNITED STATES PER CAPITA OF POPULATION.

Year.	Population.	Consumption, Pounds per Capita. Portland.	All Kinds.
1880	50,155,783	1.7	13.1
1890	62,622,250	13.8	45.5
1900	75,559,258	54.7	87.3
1902	78,611,628*	91.0	121.5

*Estimated.

There is still some room for displacement of natural cement by Portland cement, though it is probable that the present use of natural cement will not be very greatly diminished. The statement that Germany produced in 1900 135 barrels of Portland cement per capital indicates a chance for considerable expansion in its use in this country. Germany uses cement largely for many purposes for which this country as yet uses only small quantities. On the other hand, this country has extended some uses far beyond their application in other countries. It is probable, therefore, that the per capita consumption of cement in this country will ultimately exceed that in Germany. Our export trade is but just beginning and probably only requires cultivation to take a considerable percentage of our production. Until we can take care of the domestic demand it is not probable that much time and effort will be spent upon the foreign trade.

The growth in the manufacture of puzzolan cement is interesting. The capacity of the plants which will be in operation at some time during 1904 is fully 1,600,000 barrels a year and the actual production will probably be materially greater than that estimated for 1903.

The natural hydraulic cement mills have an actual capacity of approximately 25,000,000 barrels a year. Their annual production is about 30 per cent. of their capacity, as compared with 50 per cent. for Portland cement plants.

THE CONCRETE BRIDGE OF THE ILLINOIS CENTRAL RAILROAD OVER THE BIG MUDDY RIVER.

In May, 1903, the Illinois Central Railroad completed a bridge across the Big Muddy river in southern Illinois, made of concrete after designs and under the supervision of H. W. Parkhurst, its engineer of bridges and buildings, which has some very interesting features. The bridge consists of three arches, each of 140 feet span, resting on abutments at the ends 31 feet thick and two piers each 21.5 feet thick. The piers and abutments were built around old stone structures which carried the former iron truss bridge, main arch was built in sections so as to form voussoirs, similar to the stones in a masonry arch, except that each one extends the full width of the bridge. The order in which they were built was arranged to load the centering symmetrically, and when half through to show alternate blocks completed. The first pair of blocks made were the skew backs, the second at the quarters, the third each side the keystone, the fourth and fifth pairs divided the spaces between those already laid, the sixth, seventh and eighth

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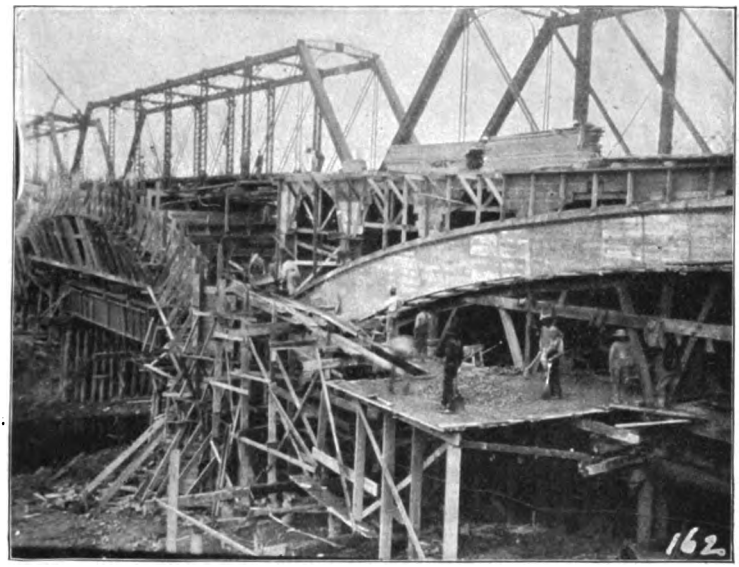
ly 20 tons for each of the piles supporting it. The photograph shows the projection of the false work outside the face of the arch on which to support the forms for depositing the concrete and the platform for the workmen. Rather wet Portland cement concrete, requiring little tamping, was used, and a facing about 1½ inches thick of Portland cement mortar was deposited next the form at the same time.

The second photograph shows one arch with the arch forms still in place and one with the arch forms removed and the forms for the spandrel arches in place.



II. BIG MUDDY CONCRETE BRIDGE, ILLINOIS CENTRAL RAILROAD,

Showing Concrete Mixing Platform to Which Derrick Delivered Materials. Concrete Was Wheeled From Platform to Place on Pier Shown Under Construction.

The base of the roadbed is about two feet above the highest point in the arch. The space between the level of the roadbed and the outer surface of the arch is filled in with spandrel arches as shown in the third view. This structure is a steel frame, a part of which is shown in the fourth view, surrounded with concrete. It is made as flexible as possible of the roadbed. They a. e covered by the extension upward of the abutment and pier ends. The space for expansion is filled with several thicknesses of corrugated asbestos board which will compress and expand so as to keep foreign matter out, and sliding surfaces between the spandrel arch structure and the pier or abutment recess, in which the joint is constructed, are provided, also protected by asbestos board. The top of the joint is covered by a lead plate with its edges set in the concrete some inches back from each side of the joint. The plate is folded down into the joint two inches, forming a channel, which is filled with an asphalt composition, extending out to cover the entire lead plate. Observations showed a maximum movement at these expansion joints of 0.012 feet for a 140-foot span between January and May, divided almost equally between the two ends of the span.

The spandrel arches are true arches

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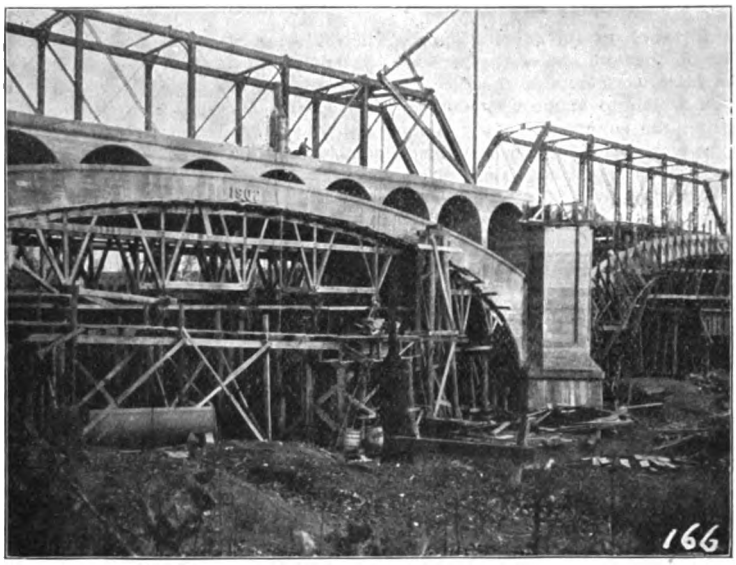
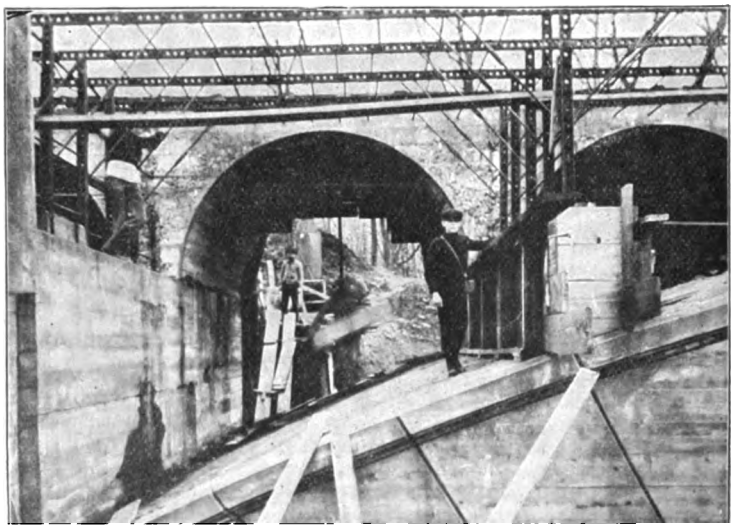


III. BIG MUDDY CONCRETE BRIDGE, ILLINOIS CENTRAL RAILROAD,
Showing Completed Main Arch and Completed End of Spandrel Arches of North Span, and Arch Voussoir Molds in Place on Center Span.



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though the depth of the keystone is but five feet.

The roadbed was raised about five feet and the old bridge was raised to carry trains during the construction of the new one. This made it possible to construct the main arches completely in one operation. The spandrel arches for half the width of the bridge were then completed and trains run over that half. The old trusses were then removed and the spandrel arches were completed. This is seen in the fourth view.

The fifth view shows the east side of the bridge with the main arches completed. The general plan of the centering is shown in the nearby span; though much of it has been removed. The centering for the center span is shown supported on plate girders of 60 feet span over the water in the stream. There were 10 of these girders. At the time this picture was taken the spandrel arches of the west half of the bridge were completed and nearly ready for the passage of trains.

The total cost of the bridge was $125,000. The railroad company furnished and drove the piles, raised the old bridge and removed it, removed the falsework and cleaned up, laid the temporary track on the west half of the bridge and did many odd jobs at a cost of $34,402, under the unfavorable conditions of railroad work. The steel cost $4,451, crushed stone $7,200, $6,700 was allowed for engineering and sundries and the concrete contractor was paid $72,128. The cost of details is reported as follows: 5,000 cubic yards of excavation for fundations at 76 cents; 12,000 cubic yards of concrete at $4 to $10 a yard, averaging $5.43; 300,000 pounds of steel at 1.2 cents a pound and 0.61 cents for handling fitting and erecting.

We are indebted to Mr. H. W. Parkhurst for information and to the German-American Portland Cement Company, whose "Owlcement" was used exclusively, for the accompanying illustrations.

ASPHALT PAVEMENT MAINTENANCE.

By F. O. Blake, Cincinnati, Ohio.

Now that we have induced the property owners in our American cities to pay over $100,000,000 for asphalt paving, and as the period for which the contractor agreed to maintain it has expired on a large percentage of it, we are confronted with a new problem, that of maintaining it properly. This is a business proposition and must be met fairly and squarely by the city officers chargeable with such responsibilities, and much depends upon the result of their efforts.

The system thus far commonly used has been to contract with paving contractors to make repairs after holes have worn into the pavement, limiting the work, as near as possible, to the size of the hole, and to pay for the work performed by the square yard. There are many serious objections to this system. It is the wrong time to make a repair after a hole has developed, for it will then require is apt to reduce the amount of asphalt used in the mixture or to adulterate what he does use.

The contractor must make it pay or go to the wall. An asphalt mixture can be produced for $2 per ton or it may cost $10 per ton, depending on the material used. It is a temptation for a contractor to use the $2 mixture in repair work, especially when he is not held responsible for the results; when it is to his interest to have the pavement go to pieces that he may reconstruct it. There are honest paving contractors, but human nature is weak and we are apt to consider our own selfish interests first when there is a conflict. This is not said to reflect on the integrity of the contractor, but to show that it is not to his interest to have a pavement everlasting and that his and the taxpayers' interests are not identical.

Along this line of reasoning can be

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V. BIG MUDDY CONCRETE BRIDGE, ILLINOIS CENTRAL,

Showing the Three Main Arches Completed. Spandrel Arches Constructed After Steel Trusses Were Removed.

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structed and the property owner is again called on to pay the bill. This system is wrong, and the political party in power must be held responsible for its continuance. Pavement should be maintained to a certain standard; it should be free from holes, waves, cracks or other defects; it should be as smooth as a billiard table. This condition is not possible under the present system of making repairs. Some system of constant renewal and of making repairs at the proper time must be adopted; the repair must be made when it is possible to make it with ten pounds instead of waiting until it requires two hundred and fifty pounds per square yard. By such a system it will be easy to maintain a pavement in perfect condition at less than half its present cost of maintenance.

I think the best results are to be had by adopting one of two methods; one is for the city to own and operate its asphalt mixing and maintenance plant, the other is to contract with competent parties to do the work by "force account."

The municipal ownership proposition has some good and many poor features. One advantage is that you are certain to get the material you pay for and as much as you need, and, more important than all other considerations, you can make the repair early and the pavement can be maintained to any standard desired. Such a policy will have the support of the property-owner and the public at large, but the opposition of the contractor whose interest it is to reconstruct. One objection to the municipal ownership proposition is that it requires skilled labor to operate it, one man of whom should be an expert and able to make chemical analyses and physical tests of the asphalt. Such men command large annual salaries and but a few cities have enough work to warrant the expense. Another bad feature about the municipal ownership plan is, that it is apt to become a political machine and be loaded down with political pensioners. Such a condition will give worse results than the present very poor system.

The advantages named above all apply to the second or "force account" proposition and it is free from the objections named. The "force account" proposition contemplates that the contractor shall furnish all machinery, tools, appliances, and the skilled labor necessary to do the work; the city pays all material and labor bills and the contractor is paid a reasonable per cent. on the gross amount for the use of his appliances and for supervision. By this proposition the city has no money tied up in machinery or tools, and receives the benefit of the expert labor without having to maintain a large salary roll. Asphalt pavement maintenance is now as much of a specialty as any other branch of municipal engineering and calls for a high class of ability and technical knowledge in this line.

Under this "force account" proposition, the city has complete control of the work, as much so as if it owned the plant. It pays for what it gets and no more. It is just to all parties. It is in the interest of the taxpayer and all others. It is one solution of the asphalt pavement maintenance problem.

ROAD MAKING IN BUXTON, ENGLAND.

By John Hatton, Mem. San. Inst., Assistant Town Surveyor.

Tarred macadam is attracting increased attention by reason of its hygienic properties, non-absorbent surface and low cost. Good roads are appreciated everywhere but perhaps nowhere more than in a health or pleasure resort. Buxton, the famous English Spa, early adopted tarred macadam. Situated in the heart of a limestone district the best possible rock is ready to hand. Tarred macadam is eminently adapted for the light business and carriage traffic of a non-manufacturing town. The even surface secures smooth running of vehicles, it is much quieter than ordinary dry macadam, wears longer, makes little dust and mud and if well laid does not form into caps and hollows. A tarred macadam roadway can be easily cleaned with horse brush and hose or water van; as a healthy road surface it competes closely with natural asphalt and, in that it is far less slippery during rain or fog, scores a point over the more costly roadway—but even tarred macadam is barely safe on a steeper grade than 1 in 20.

Tarred macadam presents good features for sidewalks. In roads overhung with trees its use avoids the unsightly and sometimes dangerous channels caused by water dropping from the branches. Water, whether from clouds or trees, runs off tarred macadam, and leaves it clean and fresh.

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Limestone is one of the best rocks for tarred macadam. Granite is certainly a harder stone, but it does not absorb the tar to the same extent. An experimental length of roadway will soon show whether the right rock has been selected. Clean stone is essential to success. Clay, earth or even quarry sap proves fatal to good work and leads to rapid decay. The stone must be dry before being tarred and if slightly warm requires less labor in mixing and can be more evenly coated with tar mixture. Too great a heat, however, partially disintegrates the stone and renders it useless.

In Buxton direct labor is employed in all municipal departments. The tarred macadam works are under the control of Town Surveyor William Hedley Grieves, Hon. Fel. Inst. San. Engrs., Mem. San. Inst., etc., and produce by the sale of material a handsome profit for Highways Department.

The rock is quarried by gelignite blasting and run on an overhead tramroad to the crusher platform, where it is dumped. The crusher, driven by a water wheel, is fed from the platform and, after crushing, the stone is automatically screened into separate compartments. Nothing is wasted; the dust is used in place of sand in making concrete and for veneering tarred macadam sidewalks. From the screening bins the stone and gravel are barrowed to the drying shed, there to be thoroughly dried and slightly warmed on the hot iron floor. Even drying throughout a large heap of stone or gravel may be obtained by occasionally turning the mass over, but a greater depth on the drying floor than one foot is not economical. The drying shed floor is built of iron plates laid on low brick walls. All the plates are removable for cleaning and the spaces between the low walls form flues conveying heat to dry the stone above. A tar boiler, fed from the store tank, is under the same roof as the drying floor. Great care is necessary in boiling the tar to the right consistency. Unless the light oils are all expelled the macadam is soft and wears badly; if the heavy oils are also driven off by too long boiling the rowed to the mixing plates, 4 feet by 4 feet sheet iron plates, laid in front of the store shed. One man brings a barrow of stone or gravel and dumps it on the plate, the tar man then pours a bucket of hot tar mixture over the heap and two mixers immediately follow and by repeated shovelings mix the stuff until every little stone is coated. The tarred macadam is then thrown to the store heap and kept in stock for three weeks or longer to allow the stone to become thoroughly saturated with the mixture. At the side of each mixing plate is a small coke fire, in which the shovels are heated from time to time. This prevents the tar sticking and lessens labor. The store shed floor may be either concrete, tarred macadam or iron plates, the latter in preference.

Power-driven machine mixers are desirable for very large consumers, but the method of hand-mixing described will be found economical for towns of moderate size.

Roadways are formed on solid rubble foundation leveled up to a true cross section and rolled. A 4-inch layer of tarred 1½-inch stone is laid on the rubble, raked even and rolled and this is followed by a 1-inch coating of tarred ½-inch gravel, and the surface is finally rolled. A 10-ton roller is sufficiently heavy for tarred macadam carriage roads.

Sidewalks are laid in a similar manner, except that the surface is finished with a ½-inch coating of tarred ¼-inch gravel laid on top of the ½-inch stuff. Each layer is rolled separately and the whole rolled finally with a one-ton manual roller. The dark appearance of sidewalks may be partly avoided by sprinkling the top coat before the final rolling with white or colored dry gravel, but this must be done sparingly or the advantage of tarred macadam will, in a great measure, be lost.

When the sidewalk gets worn slippery the surface should be thoroughly cleaned, floated with boiling tar mixture and sprinkled with limestone dust and traffic kept off until the tar has set. The mixture for veneering is the same as that used for making tar macadam. This

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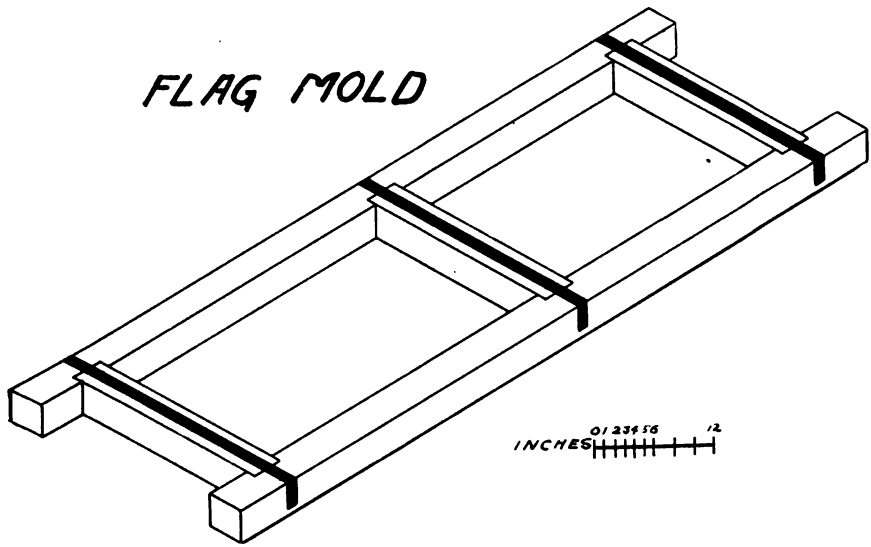

FIG. 1. MOLD POR CONCRETE SIDEWALK FLAGS, BUXTON, ENG.

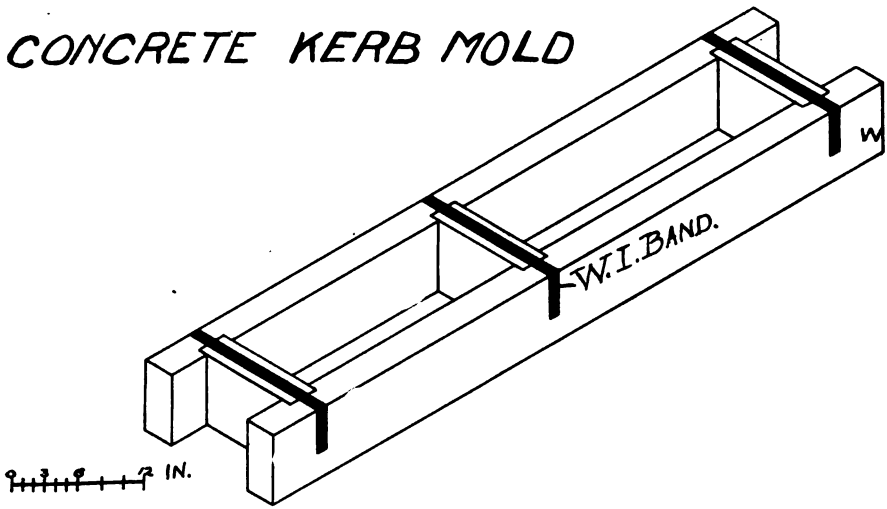

FIG. 2. MOLD FOR CONCRETE CURB, BUXTON, ENG.

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ing. Rain, great heat or frost during laying is fatal to permanent work. A fairly warm spell with slight wind is the best time for laying tarred macadam. Thorough rolling is essential and if the material sticks to the roller water must not be used to get it off. A dry scraper gives the best results, although some engineers use creosote. Lastly, traffic should be kept off the road until the surface has set. Too early use leads to the formation of ridges and consequent rapid wear. Should the roadway be much cut up by the first few days' traffic it will pay to send the roller to smooth all down again before the surface has set quite hard.

Cost will naturally vary to a great extext in different districts. The tables below are taken from some recent cost sheets from the Buxton Works. Roadways average about half a dollar per square yard to form, exclusive of rubble foundation, and to relay the whole surface from 24 cents per square yard. Footways cost practically the same amount.

Cost of tarred ½-inch gravel at works:

5 men working half hour	$0.25
9.75 gallons tar mixture	.13
1 ton ½-inch limestone gravel	.74
	$1.12

Cost of Veneering Footpaths:

Manual labor, 80 hours	$ 8.20
Team labor, 10 hours	2.40
7.78 tons limestone dust, at .72	5.60
228.21 gallons tar mixture, at .07	15.96
Cost of veneering 1,000 sq. yds.	$32.16

Only just over three cents per square yard.

Concrete Sidewalks. Sidewalks in the main business streets of Buxton are paved with artificial flags manufactured by the Town Council employes. Finding natural flags costly and in some respects unsatisfactory, Town Surveyor William Hedley Grieves experimented with limestone gravel and Portland cement and, proving that a pavement of smooth surface, hard wear and about one-third the cost of York flag could be produced, advised his Council to adopt artificial flags for sidewalks. This paving is less slippery than natural stone and much more pleasant to walk upon. The flags were so satisfactory as to soon lead to the adoption of the paving in front of important public buildings and in main business thoroughfares is chiefly laid in this material.

Cab ranks, unless well paved and frequently swilled with a deodorant, are a prolific source of complaint. The many stands in Buxton are paved with impervious concrete block, manufactured in the same way as the flags, and can be easily kept clean and free from odor. The blocks are made fifteen inches square by three inches thick and cross-grooved on the surface to afford a good foothold for horses.

Limestone, from an adjoining quarry, is used entirely for the aggregate and Portland cement of first-class quality for the matrix. The crusher screen is arranged to give ¼-inch gravel and dust together, which is barrowed to the paving shop and mixed in the proportion of three of aggregate to one of Portland cement by measure. The molds are laid on a smooth floor, preferably of iron plates, sprinkled with limestone dust to prevent sticking and hand filled with concrete which is well worked down and the surface struck off and floated smooth. After setting for 24 hours the molds are taken off and used again. The flag remains on the floor for another day. It is then taken to the open stone yard and allowed to become thoroughly hard by maturing for six months.

The flags are made from 2 feet to 3 feet, by 1 foot 6 inches, by 2½ and 3 inches thick, and the curb 9-inch by 7-inch section in 2 feet to 3 feet lengths.

The molds are made in 3-inch pine with wrought iron straps across each end. Figs. 1 and 2 show molds for flag and curb.

All the sections are made in the same manner, thicker blocks requiring a proportionately longer time to dry and mature.

Figs. 3 and 4 show the construction of roadways and sidewalks in Buxton. Cab rank blocks are laid on 6 inches of lias lime concrete. Both sidewalks and cab ranks have the joints made in Portland cement.

The cost at the shop works out at about half a dollar per square yard for 2¼-inch flag and the same sum per lineal

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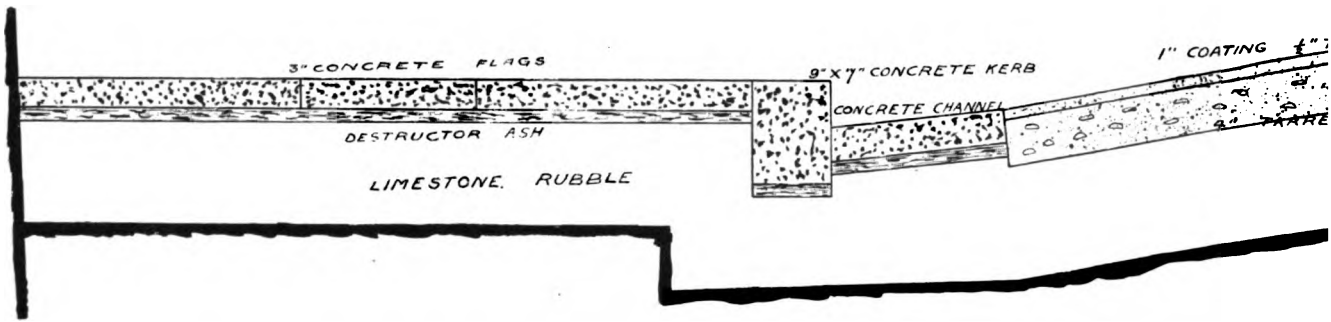
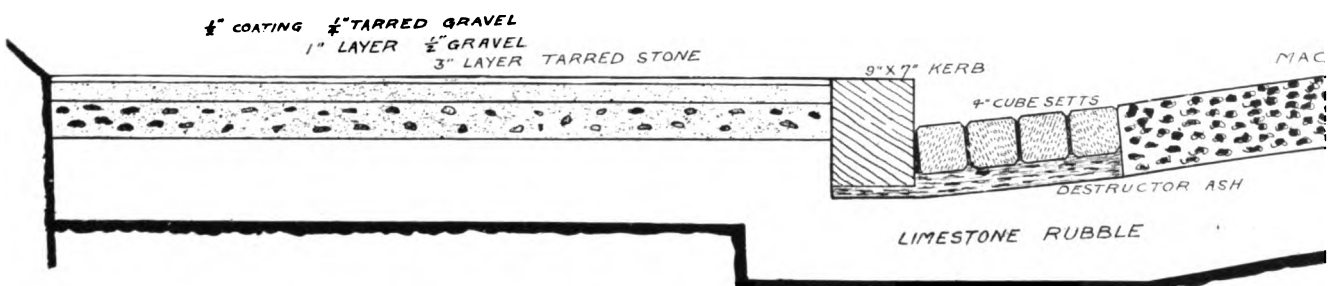


FIG. 3. CROSS-SECTION OF TARRED MACADAM STREET AND CONCRETE FLAG SIDEWALK, BUXTON, ENG.



FIG, 4. CROSS-SECTION OF MACADAM STREET AND TARRED GRAVEL SIDEWALK, BUXTON, ENG.

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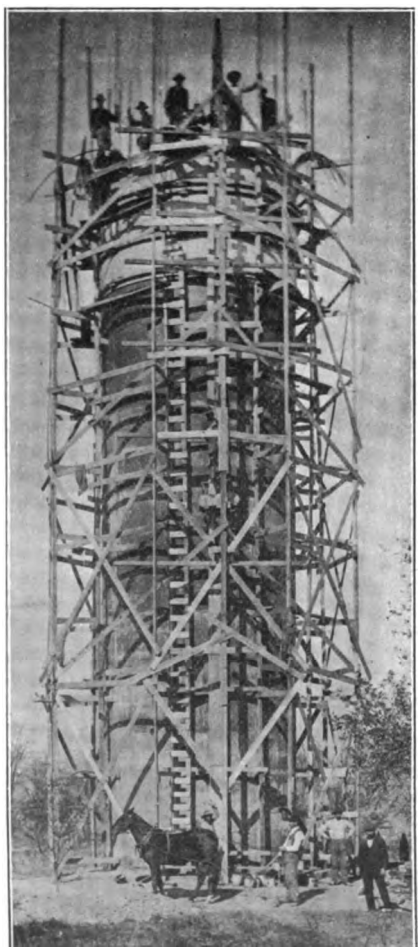
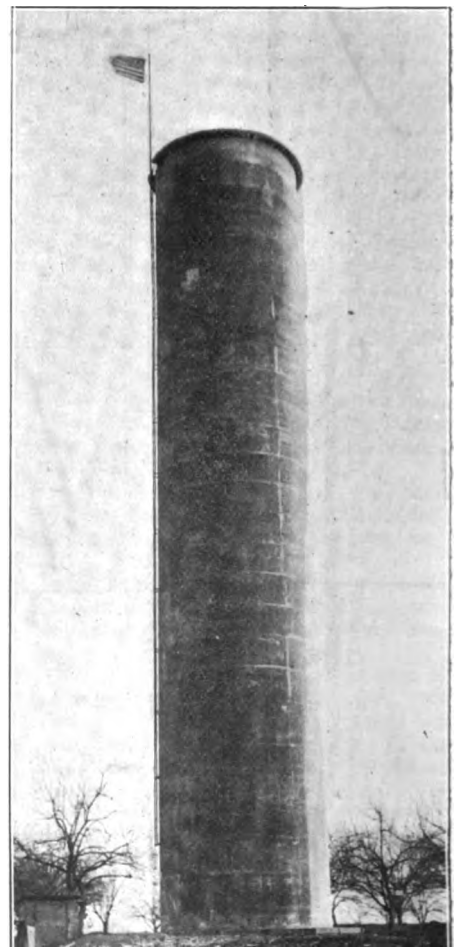
THE CONCRETE STANDPIPE AT MILFORD, OHIO.

The accompanying cuts are taken from photographs of the Milford, O., standpipe which was recently constructed by Mr. J. L. H. Barr of Batavia, O., of steel concrete, under the Weber system.

The standpipe is eighty-one feet from the base to the roof. The roof has a spring of three feet, making a total hight of eighty-four feet. The outside diameter is fifteen and a half feet. The wall is nine inches thick at the base and carries that thickness for thirty feet, when it is reduced to seven inches and again at fifty-five feet it is reduced to five inches, the reduction being made on the inside each time.

The wall is reinforced with steel "tees" 1 inch by 1⅛ inches set about three inches from the outer circumference of the wall, being placed both horizontally and perpendicularly, thus forming a net work of the steel. The horizontal tees are





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placed closer at the bottom than at the top.

The intake pipe extends eighteen inches above the bottom of the tank, and the overflow pipe to within eighteen inches of the top, giving seventy-eight feet of available water space.

These pipes as well as the washout pipe are imbedded in the concrete foundation, which is six feet deep, of octagon shape with an inscribed diameter of twenty feet. The top of the base is troweled smooth and the standpipe proper is washed with neat cement.

The foundation is made of concrete in proportions one part cement to seven parts gravel. And the wall is one part cement to three parts clean sharp sand.

The forms were made of 1⅛-inch flooring three inches wide and cut to three feet in length for staves, and nailed to ribs 4x4 inches. The top rib extended one inch above the top of the staves forming a rabbet to receive the bottom of the next form when placed on top of it. Three sets of forms were used, each set consisting of an outer and an inner form, and each divided into eight sections for convenience in handling. These sections are held together by specially prepared latches.

A ladder extends from the bottom of the tank on the inside to the top and down again on the outside to within ten feet of the base.

The structure was completed without a pause or an accident of any kind.

This class of construction will evidently supersede steel for the same purpose, as the cost is about the same and they are practically indestructible.

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EDITORIAL COMMENT

What is a Civil Engineer?
Municipal Program.
Fireproof Buildings.

WHAT IS A CIVIL ENGINEER?

The discussion over the Union Engineering Building and the apparent objection of many members of the American Society of Civil Engineers to leaving their present home for the new house to be occupied by the principal national societies, has brought into prominence the definition of Civil Engineering. The principal reason for this is the adherence of prominent engineers to the comprehensive Tredgold definition of seventy-five years ago, as the art of directing the great sources of power in nature for the use and convenience of man.

The name civil engineering was first assumed to distinguish it from military engineering, which was the first field to which the term engineering was applied. Military engineering may also be said to be included in the Tredgold definition, so that the Institution of Civil Engineers and the American Society of Civil Engineers are right in admitting military engineers to membership. In this country of peace most of the work of engineers of the War Department is strictly civil engineering in its classification.

In its early history all branches of engineering work then known were assumed by the civil engineer. One man could learn all that was known and have time to put in practice what he knew and add to the sum of knowledge. After a time the work of the civil engineers developed a class of men who operated the machines made necessary to aid him, and they in turn developed new applications of machinery and a special department of mechanical engineering which concerned itself mainly with the problems of machinery. These expert mechanicians and the engineers developed in the same special field became numerous enough to form a guild of their own and the profession of mechanical engineering was established. When electrical engineering developed, the gas engineers, the sanitary engineers, the municipal engineers, the bridge engineers, in some country or another have their separate organizations, most of them having special organizations in this country. The architect originally was a combination of architect and engineer. There has been a strong tendency to emphasize the artist in the combination to the detriment of the engineer, but modern architecture is emphasizing the engineering side, sometimes, unfortunately, to the exclusion of the artistic.

Each of these subordinate divisions of the engineering profession contains within its membership true engineers under the definition of civil engineering given, and also many experts in the technical details of the profession who are mechanicians, electricians, plumbers, draftsmen, surveyors, i. e., artisans, expert indeed, and thoroughly well informed, but not engineers, any more than the expert stone cutter who does the manual labor upon a statue is a sculptor.

There is room for a term which shall designate the true engineers in all these various professions, so-called, and will distinguish them from the great numbers of subordinate workers with which they are associated in their special lines. The time-honored term is civil engineering, and, while there might be a better, it is appropriate and may well be retained. The American Society of Civil Engineers followed the British Institution of Civil Engineers in this fundamental definition and should retain it. Its constitution makes the engineers in all the fields of mechanics, electricity, shipbuilding, mines, architecture, army and navy, eligible to membership. The mechanicians, electricians, ship carpenters, mine bosses, draftsmen, surveyors, drill masters and sailing masters have a proper place with the engineers in their various fields in the societies representing these various branches of engineering, but they

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American Society of Civil Engineers is founded. If the society has departed therefrom in any degree it is because it has had a tendency to accept the formation of the societies in the special branches of engineering activity as complete and permanent separations from what is really the parent body. Its true position is that of central organization containing the master minds in all the other societies and aiding and fostering the development of each and all of them.

It represents the entire engineering professions, not what is left after electrical, mechanical, mining, military, waterworks, gas, sanitary and bridge engineers have been taken away.

These various branches of engineering, and others yet to come, form their special societies when they find the need of them, for a comparatively small number of the members are eligible to membership in the Society of Engineers and the new society is necessary to the further advancement of the profession. It does not mean separation from the parent society, but, on the other hand, should mean co-operation with it and extension of its influence and work.

The engineering profession began in a unity due to a lack of knowledge; it is now passing through a stage of diversity owing to the vast increase in knowledge and the opening possibilities of still greater advance; there are signs that it will return within a reasonable time to the unity brought about by a clearer understanding of the true meaning and value of the Tredgold definition.

THE MUNICIPAL PROGRAM.

One of the most important subjects which the National Municipal League has under consideration is what it styles the municipal program, and much of its most valuable work has been done in educating the public up to the advisability of the adoption of a well considered plan for municipal improvements, that the engineering features may be properly taken care of, that the artistic side of the individual structures may be fully developed and, what is still more essential, more likely to be neglected, that a well designed whole may be put up as the ultimate goal to be reached, so that all individual structures may be in accordance therewith and the full effect of all details be secured through their conformity to the organic whole.

The arguments for the municipal program are not wholly those of enhanced beauty of the city, though these arguments are certainly very weighty. In almost every case the argument drawn from cold cash is even stronger. The only difficulties in securing the acceptance of this argument have been the lack of knowledge of history by the ordinary municipal officials, and the necessity of paying for the preparation of the great plan. Though slight in comparison with the savings it will insure, the proximity of this expense and the fact that it usually does not apply directly to the construction of some immediate improvement conceal the greater benefits in the future. The penny-wise and pound-foolish proverb and the dollar concealing the sun are directly applicable.

Two recent disasters on very different scales give opportunity for the adoption of two municipal programs, and may serve as examples of the very different ways in which the principles may be applied, thus suggesting to other cities the possibilities in their own cases and the opportunities for originality in their programs and in the methods of carrying them out.

The first, and greatest, is the Baltimore fire. The city of Baltimore has been hampered in its development, as was the city of Boston, by the narrowness of the plan on which it was originally laid out. Moreover, it has been very backward in the adoption of such improvements as sanitary sewers, modern pavements, electric wire conduits and transportation facilities. The wiping out of the business portion of the city with the exception of the handful of fire-proof buildings, gives an opportunity for the adoption of a comprehensive municipal program which has not been possible in any of the older cities since the Boston fire. The street plan can now be revised in the burnt district, which was the most congested business district, in accordance with the most modern ideas. There are no sewers nor pavements worthy the name which will interfere. The new sewer system, which has been so long under consideration, can easily be changed to fit the new plan, and the new streets can be paved with the best materials for their respective uses. At the same time it is possible to put in the new plan for the streets, the sewers, the conduits, and to follow them promptly with the pavements. The opportunity for making a new Baltimore is wonderful and questions of present expense and comparatively slight delay should not be permitted to stand in the way of the preparation of such a plan by experts in these lines. A general manifestation of public spirit equal to that

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of a few of its citizens will insure vast future benefits to the city, the opportunity for which may otherwise be lost forever.

On a far smaller scale, the wholesale wrecking of bridges in Indianapolis by the spring floods has given that city an opportunity at far less expense, and with far less restriction on account of necessity for immediate rebuilding, to prepare and put up as a model to which to approximate, a comprehensive plan for bridges over the streams in the city and for the protection and beautification of their beds and banks. The division of responsibility for these improvements is greater in this case than in the much greater problem before Baltimore, and the education of the public at large is therefore still more necessary.

The newly formed Indianapolis Civic Improvement Association has taken the matter up, and, through its committee on bridges, has shown the desirability of a general plan for the improvements mentioned, and the ultimate economy of working to such a plan. The division of responsibility concerning the construction of a few bridges which are needed at the earliest possible moment may prevent the full consummation of the association's wishes, but the agitation is a popular one and will have a favorable effect upon such constructions as are now in contemplation.

There is scarcely a city which cannot form a municipal program upon some line between that of reform of municipal government on the plans of the National Municipal League, revising and rebuilding of the city, fortunately on a smaller scale than Baltimore finds necessary, improving and beautifying the city's waterways and their crossings as Indianapolis proposes, with great advantage to its appearance and nearly always with equal advantage to its municipal treasury.

FIRE-PROOF BUILDINGS.

The newspaper reports that fire-proof buildings burned in the Baltimore fire as readily as any others led to some investigation of the question, and while all the results have not been received at this date, enough have come to hand to show that the fire-proof buildings have come through the furnace in a condition far better than might have been expected. There were but six or eight such fire-proof buildings in the burned district, and they stand as strong evidence of the value of this method of construction. A few more such as those which passed through the fire with the loss of everything combustible in them and with comparatively little damage to the buildings themselves, and like the court house and postoffice, which, with the open spaces about them, prevented the spread of the fire in their direction, would have made a different story. This subject will be considered more in detail hereafter. It is desirable, at this time and at all times, that the practical success of fire-proof construction in such a fire be emphasized, and that the misstatements of the daily press with reference to them be corrected as promptly and as vigorously as possible.

THE QUESTION DEPARTMENT

BOOKS ON STEEL CONCRETE CONSTRUCTION.

Will you kindly give us a list of books published that treat on concrete construction in connection with steel and expanded metal?

Researches on Reinforced Concrete" (32) is a translation from the French of Considere which has recently been published.

There are many papers in the proceedings of various societies upon the subject

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sult the list under the heading, "Concrete-Steel Arch Bridges," in the "Business Directory" elsewhere in this number of Municipal Engineering. See the list of "Articles on Reinforced Concrete" in the answer to C. H. Sonntag's question.

ARTICLES ON REINFORCED CONCRETE.

As we have had several inquiries recently with reference to the application of reinforced concrete and the calculation of its strength, we should be pleased to receive a list of articles which have appeared in your magazine on this subject. C. H. SONNTAG.
Castalia, O.

The principal articles on the subject of concrete-steel construction which have appeared in Municipal Engineering are the following:

"Westvale Concrete Bridge," vol. xxii, p. 137; "Comparison of Stone and Concrete Arch Bridges," vol. xxii, p. 159; "Melan Arches in Indianapolis," vol. xx, p. 63; "Highway Bridges of Concrete," vol. xix, p. 388; in vol. xxiii, "Concrete and Melan Arches," p. 108; "Tests of Reinforced Concrete Beams," p. 126; "Concrete-Steel Bridges," p. 155; "Dimensions of Concrete Arches," p. 199; "A Small Concrete Arch," p. 477; in vol. xxiv, "Concrete Building Construction," p. 88; "Concrete-Steel Arch Bridges," p. 127; "A Few Applications of Concrete Steel in Building," p. 128; "The Melan Arch Patent," p. 191; "Concrete Sewers," p. 253; "An Application of Concrete-Steel Construction to Retaining Walls," p. 287; "Some Uses of Concrete," p. 422; in vol. xxv, "The Concrete Sewer on Northwestern-ave., Indianapolis," p. 182; "The Construction of the Sixty-inch Reinforced Conduits of Newark, N. J.;" in vol. xxvi. "Some Details of the Philadelphia Water Filtration Plants," p. 82.

There are many more articles on cement and on concrete without reinforcement.

WASH OR PAINT FOR CONCRETE.

I would like to know the best wash or paint to cover concrete work. Give me the proportions and kind of material.
F. B. PARKS,
Valparaiso, Ind.

The answer to this question will depend upon the necessity for the coating. A simple coat of whitewash, of lime with a little cement added, might answer for some purposes. The concrete may be painted the same as wood or iron if it is a front of a building or is the wall of a room. If a waterproof coating is desired and the wall was not finished with a coat of water-tight mortar when it was constructed, Sylvester's process may be used, applying first a coat of ¾ pound of castile soap to 1 gallon of water as hot as possible, rubbing to a lather with a stiff brush, and after 24 hours a second coat of ½ pound of alum to 4 gallons of water. Three applications of each coating alternately at intervals of 24 hours should make any surface waterproof. If none of these suggestions meet the case, the exact reason for the coat should be stated.

EFFECT OF OIL ON CONCRETE FLOOR.

I should very much like to know what effect lubricating oil has on cement concrete floors in machine shops, from some one who has had actual experience, together with the name and location of the shop. H. J. C., Cincinnati, O.

This question is referred to our readers. There are certainly many floors in machine shops and some of our subscribers can report their observations. The only report in Municipal Engineering is in vol. xxiii, p. 31, where tallow on a concrete floor made the surface quite porous. The top coat was made 1 cement to 1½ sand and a damp covering was kept on the concrete for a week after it was laid.

MAGAZINES DEVOTED TO CEMENT.

Can you give the addresses of magazines devoted to the work and materials of cement? J. H. HOOK,
Lancaster, Pa.

The principal magazines devoted to cement are first "Municipal Engineering" ($2), of Indianapolis and New York, whose publishers also issue frequent editions of the "Handbook for Cement Users" ($3), and the "Directory of American Cement Industries" ($5.)

"Cement," bi-monthly, New York.

"Cement and Engineering News," monthly, Chicago.

"Le Ciment," monthly, Paris, France.

"Cement und Beton," monthly, Berlin, Germany.

Others devoting a portion of their space to cement are:

"Rock Products," monthly, Louisville, Ky.

"Cement and Slate," monthly, Allentown, Pa.

"Thonindustrie-Zeitung," weekly, Berlin, Germany.

The American publications cover different parts of the field and there is none which attempts to cover it all. This magazine devotes the portion of its time

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and space occupied by this subject to the practical use of cement in its various combinations and in the various classes of structures in which it is incorporated

BOOK ON CONCRETE BRIDGES.

Will you kindly let me know if the "Directory of American Cement Industries" for 1904 gives directions how to build bridges and other works of a similar nature? If not, what book would you recommend for giving such instructions, as I want to get a book on such works with specifications for the same.

JAMES WARREN,
Walkerton, Ont.

There is no American book on the subject of concrete bridges, which is assumed to be the subject of this question. The third edition of the "Directory of American Cement Industries" ($5), for 1904, does not include the handbook for cement users of former editions. It is omitted because it did not need immediate revision, and because the rapid expansion of the cement industry has greatly increased the size of the Directory. The "Handbook for Cement Users" is now published separately at a price of $3, and is the nearest what is asked for of any book now published. It gives the specifications for arch bridges of various kinds in concrete and in concrete steel, and is a guide to the construction of such bridges, but does not consider the methods of determining the size and strength of the structures.

Many articles on the subject of arch bridges in concrete and in concrete-steel will be found in Municipal Engineering, some of which give instructions in detail for construction. All of the literature in English upon this subject is now in society proceedings and technical periodicals.

The design of concrete arches does not differ materially from that of masonry arches and the construction does not differ materially from that of any other concrete structure, so that there is nothing particularly new or strange to be met. The introducers of various methods of constructing concrete-steel arches and bridges present their own methods of design and construction in the advertising literature which they issue, and most designers of such structures follow their methods more or less closely. The list

HOW TO BUILD CONCRETE CHIMNEY.

I have a concrete chimney to build, 85 feet high, 3 feet of flue on the inside and walls 9 inches thick at top, 8 feet square at bottom, walls 18 inches thick, a square chimney. Can you give me any information regarding system of centering and construction?

B. V. H., London, Ont.

Reference may be made to the description of the construction of the concrete standpipe at Milford, O., elsewhere in this number of Municipal Engineering. The method of placing the concrete, and the method of putting up and removing forms can be used, whatever system of reinforcing or if concrete alone is used.

CONCRETE WALK WITH NATURAL CEMENT IN BASE AND PORTLAND CEMENT IN TOP.

I have just completed 18,000 square feet of cement floors, government work, under the following specifications: Base, three inches thick, one part natural cement, two parts sand and four parts gravel; top, one inch thick, one part Portland cement and one and one-half parts sand. Both the natural and Portland cements were tested and were accepted. The work was done according to specifications and to the satisfaction of the superintendent in charge. Now the top is beginning to separate from the base and the superintendent has condemned it and ordered it replaced. I have protested, as I contend that a bond cannot be formed between natural and Portland cements, owing to their different properties and manner of setting. (None of the work was frozen.) I protested before beginning the work, but you may know how useless that is under government specifications. I cannot give the scientific reasons why natural and Portland cements will not bond together, but I know by an experience of eighteen years in the business that they will not. I have also made inquiries of several contractors and they are all of the same opinion. I wish to show to the government superintendent the reasons why they will not bond together. If you can secure for me any information along this line it will be appreciated.

C. W. H., Omaha, Neb.

There are several very good reasons why a Portland cement top for a cement walk or floor cannot be guaranteed to keep its connection with a base made

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have large amounts of magnesia. The action of these substances is detrimental to Portland cement, and accounts for the inability of natural cement concrete to stand exposure to the weather. In case the natural cements are of this nature, a layer, perhaps exceedingly thin, of weak and granular concrete is likely to form between the top and the base. This prevents the intimate union of the two which is an absolute essential to a permanent walk, for the greater expansion of the top with an increase in temperature will soon separate the two on this plane of weakness. The swelling of the natural cement concrete from the action of the free lime, magnesia, etc., has an early tendency to disintegrate a thin slab such as a sidewalk or floor is, and this would have the same effect in separating the Portland cement top from it.

The two kinds of cement require materially different proportions of water, and natural cement is usually very quick setting as compared with good Portland cements suitable for sidewalk work. It is extremely difficult, and in some cases it is impossible, to get the top in place promptly enough to permit the base and top to set together, which is essential to the integrity of the walk.

It is sometimes claimed that the difference in the coefficient of expansion of natural and Portland cement concretes is the cause for the separation. but this troublesome difference in expansion is rather that between the top of the walk. which is open to the great changes of temperature from direct sun and heavy frost, and the base, which is protected from sudden changes in temperature and therefore expands and contracts much less and far more slowly. The same trouble in separation of top from base is found in walks and floors made entirely with Portland cement in case the base is permitted to set before the top is put on, or there is not complete combination of the two layers from any other cause.

The difference in chemical action of the two kinds of cement, the tendency of some natural cements to disintegration from chemical actions which are carefully provided against in the manufacture of Portland cement, the absolute necessity of a perfect bond between the two layers of the walk and an equality in their strength, are the true reasons for the very general failures of walks and floors made according to the method described in the question.

It may be suggested that the base and top of a Portland cement walk are not of equal strength on account of the differences in proportions of cement and sand, but many experiments have shown that there is much less difference in strength, especially under compression, than the differences in proportions would indicate, and what difference there is is far less than that between the natural cement concrete in the base described and the Portland cement concrete in the top.

It will probably not be possible to put a new top on the old base which will keep its place, because the exposure of the natural cement concrete has still further weakened it, and because it is almost impossible to put a top on a base which has set, so that it will keep its place. The chemical actions in the cement have probably been completed sufficiently not to interfere.

There are a few cases in which walks under such a specification have been successful, according to reports, though the writer has never seen a well authenticated case. The detrimental chemical actions were undoubtedly absent in these cases, the two layers happened to be well joined and probably the exposure of the walk or floor has been slight, so that the tendency to separation of the two layers has been smal. The word "happened" is used purposely, for the number of successes is so small and the reasons for them are so little known that the term is properly applied. The same may be said of successful attempts to put a new top on an old base.

COST OF CONCRETE SEWER.

We would like to know the approximate cost of a concrete sewer 6 feet in diameter with an average cut of 13 feet. Gravel costs $1 a cubic yard and Portland cement $1.50 a barrel on the line of the ditch and labor $1.75 a day. The trench is in hard clay, with very large boulders in the line.

J. M., Erie, Pa.

Perhaps our readers can give some idea of the cost of such a sewer from their own experience. Some figures from Washington, D. C., give the cost of excavation at 60 to 70 cents a cubic yard and concrete sewer complete at $7.50 a cubic yard in place. The cubic yards of excavation per linear foot of sewer are easily computed, and if the thickness of the concrete is given, the cubic yards per foot of sewer can be computed quite as readily. There is considerable variation in the bids on various Washington sewers on account of differences in conditions and in contractors, the bids for excava-

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tion varying from 30 cents to $1.10 a cubic yard and for Portland cement concrete from $6.41 to $9.50. Cement cost $1.40 to $1.50 a barrel.

A TRENCHING MACHINE.

Can you give me the address of the manufacturer of the trenching machine described on page 275 of vol. xviii of Municipal Engineering. I have eight miles of farm drains to construct from 3 feet to 10 feet in depth and am looking for an excavator which will not mire in the soft ground. C. C., Danville, Ill.

The machine refered to was operated by John A. McGarry & Co., 189 Racine-ave., Chicago, Ill. Possibly the manufacturers named under the heading "Trenching Machines" in the "Business Directory" can supply a machine which will do the work. The revolving wheel machine of the Municipal Engineering and Contracting Company, used for digging water pipe trenches might be adapted to this work. Can our readers suggest any machines which they have found successful for this class of work?

CITIES PUMPING SEWAGE.

Our city is desirous of collecting information regarding pumping sewage from low levels into the gravity mains, and would be pleased to know the names of any cities which have pumping stations installed in connection with their system of sewerage.

C. H. TOPP.
City Engineer, Victoria, B. C.

In Municipal Engineering, vol. xxv, p. 178 and vol. xxvi, p. 26, will be found a partial answer to this question, including Boston, Chicago, a large New Jersey drainage district, New Orleans, Providence, Madison, Wis., Pittsfield, Salem, Webster, Swampscott, and others in Massachusetts, Santa Cruz, and at one time, San Rafael, Cal. We will add to this list the names of other towns and cities in the United States or elsewhere which are sent us by our readers.

BEST METHOD OF GARBAGE DISPOSAL.

ments are really such. The article on page 28 of the January number of Municipal Engineering is very favorable to the incineration process, but there are equally pronounced opinions in favor of reduction processes. The fact is that, like many other engineering questions, each problem must be solved for itself, and the process to be adopted for a given city must be chosen with due reference to the methods of collection of garbage, the customs as to separation of garbage and refuse, the danger of producing nuisance in the operation of the plant, the composition of the refuse and garbage, the possibilities of profit from the product of the works, etc., all of which are variables requiring special study for the determination of their probable values in any particular case.

The fact that the reduction works are all in the hands of private companies which seem to be operating profitably under their contracts with cities, suggests the value of these processes. The greater freedom from nuisance of many incineration plants is an argument in their favor. These are only two sample arguments, of which there are many on both sides.

Unfortunately the question of the proper disposal of garbage has never been considered to be an engineering question, which it really is, and there are very few instances in this country of adequate studies of the problem and thoroughly good plants well designed to fit the local conditions.

EXPANSION AND SAG OF STEEL TAPE.

What is the co-efficient of linear expansion for a surveyor's steel tape for each degree of increase or decrease in temperature, Fahrenheit, as recognized by the U. S. government as standard?

When dynamometer is used to compensate for sag in 100-foot steel tape, what is the necessary stress in pounds to be applied on dynamometer to correct for sag?

SUBSCRIBER, Seattle, Wash.

These questions are considered in detail in Johnson's "Surveying" ($4) in the

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be determined when the tape is officially tested.

The proper tension to be used on a steel tape is such that the stretch due to it will equal the shortening due to the sag. The weight and length of the tape and distances between points of support are quantities which must be known in order to determine this tension. To determine the working tension, the pull when the length of the tape was tested must also be known. Prof. Johnson gives, as an example of the use of the tables and diagram which he has computed, the case of a 50-foot tape weighing 6 ounces on which the pull when tested for length was 5 pounds, and determines the pull to which the tape should be subjected as 9¼ pounds. In the case of a 100-foot tape weighing 12 ounces, with same pull at test, the working tension will be found from the diagram to be about 9⅝ pounds. Errors from weights greater will be less than those for less weights. The chapter on geodetic surveying gives methods of correcting measured lengths when the temperatures and tensions are measured, there being no attempt to make them exactly what they should be to produce the exact proper length of tape at time of measurement.

PLANS FOR CITY PARK.

You will greatly oblige me by sending me some plans for a city park 300 feet square, or the address of some one who can give the information.

J. L. N., Mitchell, S. D.

Municipal Engineering has not published any plans for such a park. Our correspondent is referred to the civil engineers whose names will be found under that heading in the "Business Directory" elsewhere in this number. Several of the engineers whose cards are in the advertising pages mention parks as one of their specialties.

BOOKS FOR A CITY ENGINEER.

Please give me names of books on estimates and report on street paving, sanitary sewers and road building.

W. H. GAINEY,
Valdosta, Ga.

Can you send me the titles of two or three of the best text books for city engineers, touching on his varied duties, and especially on the manner of constructing the work, the best materials, etc?

CLAY STACKER,
Clarksville, Tenn.

There is no single book covering the ground desired. McCullough's "Municipal Public Works" (50 cents) is an excellent little discussion of the problems coming under its title, but it is necessary to go for detail to books devoted to paving, sewerage, bridges and other special branches. Quite a full list of books under each subdivision of the city engineer's work in an article entitled "A City Engineer's Library" in this department, in vol. xxiv, p. 277.

ENFORCEMENT OF HOUSE NUMBERING ORDINANCE.

Our city has passed in due form and regular enactment an ordinance for the numbering of the buildings, providing as follows:

"Sec. 3. The owner or owners of all improved and occupied lots or parts of lots shall have posted in a conspicuous place on some building thereon such numerals as correspond with the number of such lot or part of lot, and as shall be furnished them by the City Engineer.

"Sec. 4. Any person neglecting for sixty days after having been notified by the City Engineer or City Marshal of the numerals to be placed upon his or her property, shall upon conviction be liable for a fine in any sum not exceeding $10, and moreover, the city may place upon his or her property such numerals as required, and file an itemized cost of same with the County Clerk, and such shall be added to the levy as a special tax, and shall be a lien upon the property collectable as any other tax."

I do not find anything in the statutes of Nebraska authorizing such a law, and the question is: Can it be enforced?

J. P. HAZARD.
Alliance, Neb.

The numbering of houses is a police regulation. It is a necessary regulation for cities and can be enforced as other police regulations duly established by ordinance are enforced.

Possibly the courts would take cognizance of any unreasonableness in such an ordinance and require modification on this account, but the principle of the ordinance would undoubtedly be upheld.

TESTING WATER METERS.

Will you please give me some information through your question department about testing water meters?

JOHN J. WEIR,
New Glasgow, N. S.

In the Journal of the New England Water Works Association for Dec., 1908, will be found an article on testing some 6-inch water meters which probably gives the information desired. The tests were made:

First. To determine the loss of head or retardation of flow by the passage through them of varying quantities of water, say from 25 cubic feet per minute

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to as large an amount as would flow under the conditions resulting, possibly as high as 300 to 400 cubic feet per minute in some types of meters.

Second. To determine how small a stream each meter would register, and with what per cent. of slip or leakage, or, in other words, what the unrecorded flow will amount to on various discharges, from the smallest stream possible to register, as well as their accuracy on various-sized streams up to their capacity.

Since the meters were large, special arrangements were made for getting rid of the water. The ordinary fire hose nozzle was used to measure the amount of water passed, using Freeman's tables of pressures and discharges. Pressure gauges on each side of the water showed the loss in pressure in passing through the meter. This varied greatly with different meters and the results are shown in detail in the paper.

For the second class of experiments the water passing the meter was weighed and the volume thus obtained was compared with the meter reading to determine the error in the meter.

Mr. John W. Hill has a paper on a comparison of water meters in the transactions of the American Society of Civil Engineers for 1899 which has some valuable information on the subject. If our correspondent will be a little more definite as to his wants they can probably be filled to his satisfaction.

INDEX TO MUNICIPAL ENGINEERING.

I have not the liberty to make a card index to Muncipal Engineering, which would make the files more available. Are there not many subscribers in the same position? Why cannot you make and publish an index of all the volumes to date and then issue supplements every five or ten years? I think it would meet with ready sale. If you do not care to venture on the experiment, a note in the magazine that such an index would be issued if a sufficient number would subscribe for it would determine what is the desire for it.

J. WALTER ACKERMAN,
Auburn, N. Y.

pense if it is wanted. It is open to subscription and will be printed if any reasonable number of responses are made to this call.

BOOK ON BRICK PAVEMENTS.

What is the best book you have on brick pavements, including formulae for estimating on such work?

U. G. STOCKWELL,
Albany, N. Y.

Baker's "Roads and Pavements" ($5) has the best treatment of the subject of brick pavements and includes data for making estimates of quantities and cost.

NEW YORK CIVIL SERVICE EXAMINATIONS.

In your September number of 1903 there is a notice of New York City civil service examinations for inspectors of municipal work. I should like very much to get a copy of these examination papers. Can you tell me how to secure them?

JAMES H. TURNER.
Zion City, Ill.

A letter addressed to the secretary of the Board of City Civil Service Commissioners, New York City, would probably secure copies of sets of examination questions which have been used.

SHELL ROAD AS FOUNDATION FOR BRICK PAVEMENT.

Will you please give me, through the columns of Municipal Engineering, your opinion as to whether shell streets are a good foundation for brick pavements in a town of six or seven thousand inhabitants. It has been said by some authorities that these shell streets will make a good foundation for brick pavements by putting a coat of sand on the shells and filling in the joints with brick. These shell streets are very uneven and in order to have the sand of uniform thickness it would be necessary to do quite a great deal of leveling, which would be very hard to do, and the places filled in would, of course, be much softer than those that are not disturbed, and it seems to me that this might be a serious objection. It has also been said that in case that proves an objection that the streets might be plowed up and rolled, but I

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the shell road. The latter may not occur, since the road may be worn down to a reasonable crown for a brick street.

A roller will be necessary in getting the roadway into shape for the brick and in settling the brick. Spikes may be set in the rim of the large wheel, which will loosen up the surface of the street and picks can then get hold of it. A scarifier is advertised by Julian Scholl & Co. which would seem to be the proper instrument for removing the unevenness of the street. It tears up the surface just enough for this purpose. It can be hauled by the steam roller and used either with or without the spikes on the roller wheels, as seems to be necessary. The loosened material can then be spread with pick and shovel and objectionable parts removed, the surface again rolled to uniformity and the sand cushion and brick then put in place.

REMOVAL OF SNOW FROM STREETS.

Can you give me any references to machines for melting snow in the streets?

G. W. BORTON, Philadelphia, Pa.

The daily press had some notice of a machine for melting snow from city streets, but it seems to have disappeared. A little computation of the heat which would be necessary to remove any appreicable amount of snow, and a consideration of the difficulty of getting the water into the sewers before it could freeze, gives an idea of the difficulties in the way and of the reasons for failure of any chance apparatus for this purpose.

A more feasible suggestion is that made by a correspondent in Municipal Engineering, vol. vi, p. 53. He would lay steam pipes under the gutters which would be of material not injured by the heat. The snow in the gutters would melt and run to the catch-basins and the snow could be scraped from the street into the gutters as rapidly as it disappeared from them. The large amount of heat required would make this a slow process, but it would be more rapid than the machine and would keep the melted water running to the sewer.

Detroit dumps snow into the nearest sewer manhole or large sewer, as described in vol. xxii, p. 44. The removal of snow from New York streets by carts is described in vol. xii, p. 38.

BRICK ROADS IN RURAL DISTRICTS.

Can you give me any information as to construction of brick roads in rural districts? We would like to find out where such roads have been laid and construction of same; also how they are wearing, and what kind of satisfaction they are giving.

A. M. COBBE,
Jamestown, N. Y.

In the proceedings of the Ohio Society of Surveyors and Civil Engineers for 1902 will be found a paper on "Paving a Country Road," by Sam Huston, C. E., of Steubenville, O., who describes a road 10 feet wide laid on one-half a roadway, leaving the other half for use in good weather. The roadbed is thoroughly drained with all the necessary transverse and longitudinal drain tile. A curb of vitrified clay is set at each edge of the brick and flush with its surface. The drain trenches were filled with 2½-inch fragments of vitrified clay, waste from tile factories, and a 6-inch layer served as foundation for the brick. The sand cushion was one inch thick. The itemized cost was as follows for 5,479 feet, slightly over one mile:

Excavation, 10,334 cu, yds.	$1,240.08
Overhaul, 47,490 cu. yds.	474.90
Grubbing trees, 18	18.00
4-inch sewer pipe, 8,012 ft	480.72
Curbing, 10,784 ft.	2,156.80
Foundation, 3,413 cu. yds.	750.86
Paving, 6,243 sq. yds.	3,246.36
Total	$8,367.72

Can our readers give other examples in detail of this class of work?

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MUNICIPAL MATTERS IN COURT

Higher Courts—Cicero Water Rates—Venezuelan Asphalt Suit—Non-Abutting Lot Assessments—Park for Water-Works—Bay State Gas Co.—Bitulithic Infringement Suits—Chicago's 75-cent Gas—Defective Water Supply—Chicago Debt Limit—Contaminated Water Supply—Destroying Public Property—Illinois and Michigan Canal.

Abstracts from Decisions of the Higher Courts on Matters Relating to Municipal Improvements.

Prepared by Russell T. Byers, LL. B., Indianapolis, Ind.

Assessments—Validity—In Duluth, petition for local improvements must contain the names of a majority of the property-owners to be affected. This provision is jurisdictional and until complied with confers no authority upon the Council to act.—Hawkins vs. Horton et al. 97 N. W. Rep. (Minn.) 1053.

Reassessing Benefits—Equal Rate of Assessment—The Portland City charter provides that the Council may reassess benefits on an equitable basis when the original assessment is invalid. This section is retroactive in effect. The state constitution, Art. 9, Sec. 1, requiring an equal rate of assessment and taxation does not apply to the assessment of property for local improvements.—Kadderly et al. vs. City of Portland et al. 74 Pac. Rep. (Oregon) 710.

Local Improvements—Front Foot Rule—Collateral Attack—Though a resolution to make improvements be not passed by a two-thirds vote of the Council, if the requisite number vote to enter into the contract for that specific improvement and the assessment be duly confirmed, the assessment is not open to collateral attack in a suit brought for the collection of the assessment. The application er, and at the time of entering into the contract for the same the borough's indebtedness was less than the 2 per cent. limit. The contract imposed no liability on the borough, but viewers afterward assessed a part of the cost against the city. Subsequently, and before the bonds to pay for the sewer had been issued, ordinances were passed authorizing other expenditures and bonds to pay for same. These, with the original indebtedness and the cost of building the sewer, exceeded the 2 per cent. limit. Held, that the mere passage of the subsequent ordinance did not create an indebtedness, that the obligation for the sewer was prior to any arising under such subsequent ordinances and that the indebtedness incident to the construction of sewer did not increase the debt beyond the 2 per cent. limit. Redding et al. vs. Esplen Borough et al., 56 Atl. Rep. (Penn.), 431.

Sidewalks, Grades and Assessments—Publication of Corrections—When the ordinance providing for a sidewalk declares that it shall be constructed on a grade established by an ordinance then on file, and such grade establishing ordinance was really passed and approved the same day as the sidewalk ordinance, there is no such inconsistency as will avoid the assessment, the grade ordinance being sufficiently identified to give notice of the grade. The fact that an ordinance does not provide what shall be the exact num-

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city has general power to legislate on a given subject, an ordinance relating to such subject, if unreasonable, unjust or oppressive, is invalid. Where a macadam pavement has been in place less than four years, is in good condition and there is no reason for removing it, an ordinance requiring it to be torn up is void. City of Chicago vs. Brown et al., 69 N. E. Rep. (Ill.), 65.

Council's Power to Assess—Council does not have power to assess property not assessed by the commissioners. Spring Steel & Co. vs. City of Anderson et al., 69 N. E. Rep. (Ind.) 404.

Damage from Changing Grade—In an action for damages, incident to a change of the street grade, is is no defense that the plaintiff bought the property with knowledge that the improvement had been ordered. One of the items of damage is the reasonable cost of grading plaintiff's front lot as being an item of special damage. Improvements made by neighbors are not items of special benefits. Pickles vs. City of Ansonia, 56 Atl. Rep. (Conn.), 552.

Modification of Improvement Resolution —Public Hearing—Voting to abandon the improvement provided for in the first resolution and directing the engineer to prepare a second estimate which was subsequently modified by substituting a different material and a cheaper method of construction, is not such an abandonment as to make a second hearing necessary. McChesney et al. vs. City of Chicago, 69 N. E. Rep. (Ill.) 82.

Revocation of Permission to Use Streets —Where the right to revoke permission to use city streets for laying electric light conduits exists, by virtue of reservations in ordinances, it may be exercised by the legislature. Boston Electric & Co. vs. Boston & Co., 69 N. E. Rep. (Mass.) 346.

Vacation of Streets—The town council had power to vacate a public street, but only for the public benefit. An ordinance providing for vacation of a street for the benefit of a private individual is void. An ordinance of a town council ordering in general words, the reduction in the width of a street from forty to fifteen feet is void for uncertainty. Pence vs. Bryant et al., 46 S. E. Rep. (W Va.) 275.

Vacation of Streets—The statute relating to vacation of streets is applicable to the vacation of one side of a street. Where such vacation takes place over the objection of property owners it is void and subject to collateral attack. Lowe et al. vs. Lawrenceburg et al., 69 N. E. Rep. (Ind.) 148.

Cicero Water Rates Must Be Same as Chicago's.

The Supreme Court of Illinois rendered a decision Feb. 17 in the case of the town of Cicero vs. Chicago, in which it held that under the sanitary district act Cicero is entitled to pure water at the same rate Chicago pays. The town filed a petition in the Circuit Court of Cook county for a writ of mandamus to compel the city of Chicago to furnish the people of Cicero with pure water at the rates prevailing in Chicago. The town set up the sanitary district, claiming it was a part of the district and had paid its share of the taxes to construct and maintain the canal, the object of which was to furnish pure water to the people of the district. Among other things the court holds that the Legislature had no right to change the boundaries of the sanitary district so it would take in additional territory.

Venezuelan Asphalt Lake Suit Decided.

The Federal High Court at Caracas, Venezuela, has handed down a decision holding that the claim of Warner & Quinlan of Syracuse, N. Y., to possession of the Felicidad asphalt mine, a portion of the asphalt lake in the State of Bermudez, claimed also by the New York and Bermudez Asphalt Company, which holds a concession to work the lake, is null and void. The court bases its opinion on the argument that, while the concession of the Bermudez Company was valid, no claim to the Felicidad mine could be granted. The Felicidad mine was bought in 1898 by Warner & Quinlan.

Liability of Lots Not Abutting on Street.

The meaning of that section of the Barrett law which provides for assessing the cost of a street improvement against the property lying back from the street, but within 150 feet of it, in case the abutting property does not sell for enough to pay the expense, was argued before the Indiana Supreme Court, at Indianapolis, February 17. The suit came from Kokomo. William H. Voris sued the Pittsburg Plate Glass Company on some street improvement bonds that were issued ten years ago and purchased by him. No assessment was levied on the company's property, and it was not until after Voris had forclosed his lien on the abutting property and it has been sold that he set up a claim to the property

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lying behind it. The attorneys for Mr. Voris rely on the construction which they give to a clause in the statute providing that if the abutting land does not sell for enough to pay an assessment all land within 150 feet of the street shall be subject to sale. The appellee's attorneys insist, however, that this applies only in case immediate steps are taken by the contractor to enforce payment, and an assessment is duly levied on the back property.

In this case no assessment was made against any property except the abutting lots. The attorneys also insist that Barrett law bonds can only be issued after a final assessment has been made and after the owner of the property assessed has signed a personal undertaking to pay the assessment, whether the assessment is legal or not. They argue, therefore, that the purchaser of bonds must be regarded as having taken the personal obligation of the abutting lot owner, secured by a lien on his property, and is not in the same situation as the contractor was before bonds were issued.

City Enjoined from Using Park for Water Works Station.

A decision was rendered recently by Judge Joseph A. Gill of the United States Court at Vinita, Ind., Ter., on the question of the right of an incorporated town or city in the Indian Territory to use its parks for public works. The attempt of the municipal authorities to erect a standpipe, reservoir, power house, tanks, etc., in the North Park of the city of Vinita for the purpose of constructing a water works plant and a sewerage system brought out the decision. The city had awarded the contract for constructing the water works plant and the contractors were ready to go to work when property-owners facing the park where the plant was to be erected filed an application for an injunction against the city and the contractors to prevent them from using the park for that purpose. The decision sustained the property-owners in their contention.

Bay State Gas Company's Reorganization Troubles.

Judge Kirkpatrick of the United States Circuit Court denied, Feb. 9, the applica-

Bay State Gas Company of New Jersey, a co-plaintiff in a suit now pending in the supreme judicial court of Massachusetts, wherein Mr. Pepper seeks to set aside the sale of $11,000,000 worth of bonds made last July upon the reorganization of the New Jersey corporation. The court allowed Mr. Hallock, however, to be made a party defendant in the suit in order that he might defend his action in bringing about the reorganization and the subsequent sale of the bonds. It was agreed that this act should not be considered in any way as casting discredit upon Mr. Hallock's action as receiver of the New Jersey corporation. Mr. Hallock's counsel opposed the application on the grounds that his client had acted in good faith in all his acts as receiver and any sales that he made or brought about were solely in the interests of the stockholders. The counsel for the New Jersey corporation declared that the purpose of the application was only to harass the local corporation and its receiver. He contended that the application to make the receiver for the New Jersey corporation a co-plaintiff in the suit would, if granted, not only bring discredit upon the receiver himself, but upon the court as well, for Mr. Hallock had been appointed by him.

Suit for Infringment of Bitulithic Patents.

Warren Brothers Company of Boston, Mass., have instituted suit in the United States Court at Grand Rapids, Mich., against the city of Muskegon, Mich., to recover damages, alleging that a bituminous macadam pavement recently completed in that city by the Barber Asphalt Paving Company is an infringement of patents. A similar action is pending against the city of Owosso.

Chicago Cannot Have 75-Cent Gas.

A decision was rendered by Judge Grosscup of the United States Circuit Court at Chicago, Jan. 25, against the city of Chicago in the 75-cent gas cases. He declares that the state did not delegate the city the power to regulate the price of gas. The decision was rendered in the case of D. O. Mills, as stockholder in the People's Gas Light and Coke Company, and Frank G. Jones, as stockholder in the Northwestern Coal and Coke

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Ukiah City Cannot Collect Damages for Defective Water Supply.

The Supreme Court of California rendered a decision Feb. 11 holding that Ukiah City is not entitled to damages from the Ukiah Water and Improvement Company by reason of the losses sustained by the former at a fire where the water supply did not prove adequate. The municipal authorities allege that the corporation was under contract to furnish a sufficient supply of water for fire-fighting purposes. The Supreme Court holds that there was no express covenant in the contract providing for any special quantity or pressure of water, and cited numerous cases similar to this one showing that no damages may be obtained unless the terms of the contract specially provide for services which are not given in the emergencies where losses are sustained. A jury in the lower court rendered a verdict in favor of the town, but the judge granted a new trial and an appeal was taken from his order by the plaintiff. The Supreme Court sustains the judge of the lower court.

Chicago's Debt Limit.

The Illinois Supreme Court has rendered a decision giving the city of Chicago the power to issue bonds up to $20,550,000, which is 5 per cent. of the assessed valuation of the city—the debt which the city can assume under its constitution. World's Fair bonds of $4,511,000 are held to be outside of the city's bonded indebtedness, and the sinking fund reserve is $1,049.000, and is by the court credited against the bonded debt, reducing it by that amount. The special assessment debt for public improvements, amounting to $2,000.000, is not included in the bonded indebtedness. The city, therefore, has the right to immediately issue bonds to the amount of $20,550,000 for any corporate purpose. The entire indebtedness of the city at the present time is $15,980.000 and the outstanding judgments not provided for amount to $4,871,182. As soon as the bonds are issued these bonds will be paid in full and the debt paid.

Damages Sought for Contaminated Water Supply in Ft. Wayne.

The grand jury at Ft. Wayne found contaminated water in the mains recently and indicted three water works trustees and the Pennsylvania Railroad Company on the charge of committing public nuisance. The Pennsylvania Company, which gets its water from the river, but uses the city water when the company pumps are out of order, forgot to turn the valve and pumped river water on high pressure into the city mains through a secret connection which was made during another administration.

Village Board Indicted for Destroying Public Property.

The members of the village board of Harmon, Ill., were arrested recently on warrants sworn out by property-owners on charges of destroying public property. The board had built a cement walk before the store of George and John Swartz. The firm refused to pay for the walk, and it was torn up by order of the board. A man conducting a saloon in the Swartz building petitioned the board for an extension of license. On the ground that he was occupying the Swartz building the board refused the license and proceedings were then instituted against it.

End of Illinois and Michigan Canal.

The Illinois Supreme Court handed down a decision Feb. 17 directing the Sangamon County Circuit Court to enjoin the canal commissioners from drawing any part of the last appropriation of the General Assembly. Representatives L. Y. Sherman and Richard E. Burke of Chicago made a fight in the last General Assembly against a bill appropriating $152,950 for maintaining the canal and operating the Bridgeport pumping station. Mr. Burke's contention was that such an appropriation was in direct violation of a provision of the state constitution which prohibits appropriation of public moneys for the maintenance of railroads and canals. He was granted a temporary injunction in the Circuit Court, but on hearing Judge Creighton dissolved the injunction. The Supreme Court's decision sustains Mr. Burke at every point. The opinion sets out in detail its answer to the contentions of the appellees, as follows:

The court gathers that the constitutional content of the provision relating to the canal was that the power to sell or lease the water way should remain with the people, and the management, if that shall seem wise and best, should be possessed by the Legislature, to which power of management there was attached an inhibition against the application of the public moneys to any of the purposes of the canal. The constitutional intent was and is, the court says, that the canal shall be self-supporting and that the peo-

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ple of the state shall not be taxed to aid it in any way.

After reviewing at some length the debates of members of the constitutional convention, as aiding to a correct determination of the intent of the framers of the instrument, the court says:

Though it does not aid to the determination of the question of power of the Legislature to make the appropriation in question it is not inappropriaate to remark that the fears entertained by members of the constitutional convention that more modern and more speedy means of transporting passengers and commodities would soon supplant the canal and divert traffic from it and the canal would become practically of no use as a waterway or highway of traffic and commerce and would cease to produce an income sufficient to pay the expenses connected with its management and would, unless restrained by the constitution, become a regular applicant at the door of the state treasury for appropriation of money of the taxpayers of the state, have been verified.

In 1876 the tolls received for the use of the canal aggregated $113,293, but since that year there has been a marked and substantially gradual decrease in such receipts. In 1900, so little demand was there for the canal as a highway or waterway for the transportation of person or property that but $13,867 was paid as tolls. In 1901 the use of the canal for purpose of trade or commerce was so little availed of that but $8,120 was collected from tolls. In addition to all receipts, of every character, during these years heavy appropriations from the treasury of the state, amounting to something more than $500,000, have been asked to meet the deficiences arising from the management and operation of the canal. The canal has practically fallen into disuse for any of the purposes of transportation of either persons or property and has been perverted to mere commercial purposes of supplying water power to those along its banks and selling privileges to cut ice from its pools. It is no longer a higghway of commerce.

SEWAGE AND GARBAGE

Sewer Purification at East Haven, Ind.—Stream Pollution in Minnesota—New York Sewer and Water Commission—Practice in Removing Refuse—Garbage Collection and Disposal—Evclusive Garbage Contract Void.

The Sewage Purification Plant at the Eastern Hospital for the Insane.*

By Prof. R. L. Sackett, C. E.

The Eastern Indiana Hospital for the Insane has at present a population of about 800 and uses 100 gallons of water per individual per twenty-four hours by tank measurement. The buildings are situated about twenty-five feet above and 1,500 feet distant from Cedar Creek, into which the sewage was formerly discharged. The dry weather flow was only about 100,000 to 200,000 gallons per day and the dilution was wholly insufficient. The large amount of laundry and bath water, roof water, a little surface and no ground water.

The use of disinfectants and the clothing which the inmates destroy and stuff in closets are disturbing factors requiring special attention in the design

The old main sewer of 18-inch cement tile was tapped near the buildings. In the manhole an emergency overflow was constructed so that an extraordinary storm could not choke the intercepting sewer. The latter consisted of a 10-inch line of vitrified pipe 1,100 ft. long.

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feet long, 16 feet wide and may be operated under a head from 6 to 8 feet.

Various valves are provided by which the chambers may be cleaned and the sludge discharged on the surface of the ground for irrigation purposes. The structure, excepting the slate roof, is of concrete.

An 8-foot weir leads from the tank to the dosing chamber holding from 4,000 to 6,000 gallons, depending upon the depth.

This quantity is discharged automatically, at regular intervals of about thirty minutes, when the dose is 4,000 gallons.

The apparatus, manufactured by Mr. Shields of Chicago, operates four 12-inch valves leading to sewer pipe lines which conduct the sewage to the four filter beds. These valves are mechanically operated in turn by compressed air, the air being confined in a dome under water pressure.

The foundation and walls are of Portland cement concrete in the proportions of 1 of cement to 7 of an excellent quality of bank sand and gravel.

The floor is 6 inches thick and the side walls taper from 18 inches to 12 inches in a hight of 9 feet, the total hight being 10 feet. The gables are carried out in brick.

In order to render the walls water the inner third of the wall at all corners and into all cross walls.

The structure, which is 67 feet long, 20 feet wide and 10 feet high, has no expansion joints and has developed no cracks except one on each side caused by the soil under one end of the structure being soaked with sewage and settling slightly. This settling reached its limit very soon and the filled joint has given no trouble.

From the sewer lines, the effluent passes to the four filter beds, each of which is 100 feet square. To each bed there are three cypress troughs with side openings which distribute the sewage over the bed.

SEWAGE DISPOSAL PLANT.
Eastern Indiana Hospital for Insane.

The sewage as it goes on the beds shows only a slight milkiness in color, and the the solids are not visible to the naked eye.

The ground was graded to proper form and a grillage of farm tile was laid, leading to a 12-inch trunk, which discharges into Clear Creek about 150 feet distant.

On the tile a 6-inch layer of coarse gravel was placed, obtained by screening a portion of the top material. Three feet of bank gravel, practically unscreened, but very uniform in quality, and only 600 feet distant, completed the filters.

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ing to nitrites and nitrates. The process is biological, not chemical, and the material of the filter is not important so long as it is insoluble and maintains a porous condition. More than one microorganism has the power to take oxygen from the air and combine it with the ammoniacal fluid from the tank, thus producing water and nitrates.

If the process were perfect only pure water and harmless gases would be left. To maintain the efficiency, the supply of air to the filter must be about three times the quantity of nitrogen. Tests have shown that a quantity of air equal to from five to nine times the volume of sewage was flowing through the pores of the sand. Tests of the air coming from filter drains show that the oxygen is reduced, while carbon dioxide and nitrogen are increased, showing conclusively that the predicted action has taken place. (Bacterial Purification of Sewage by Barwise, page 38.)

The plant was put in operation Dec. 4 last and the effluent was soon very satisfactory to the eye.

When 5 degrees below zero, Fahrenheit, the temperature of the sewage thawed the frozen ground slowly, and at no time was the operation interfered with by freezing, even when the temperature was 20 degrees below zero.

As scientific data are lacking, it is proposed to make tests of three months' duration on various periods of septic action and the effect of large and small doses on the filters.

Analyses will be made of the sewage, effluent and filtrate, together with temperature, chemical, microscopic and biological analyses. In this manner the most efficient conditions under which to run this plant will be determined. It is only by providing for a change in the septic period and by experiment that the highest efficiency can be obtained, as the tank is so sensitive to local conditions that no rule of thumb will give the best results.

Extravagant claims have been made for the new processes of sewage purification, and they have not always been realized. Bacteriological processes require the very greatest care in weighing local and peculiar conditions and in adapting the requisite means to the end.

EFFECT OF EAST HAVEN FILTER ON SEWAGE.

Stream Pollution Prohibited in Minnesota.

The Minnesota State Board of Health has declared the discharge of sewage by any village, city or other municipality by means of artificial drains or a sewerage system into any well, pond, lake, stream or river in Minnesota to be a public nuisance, and it will be prohibited unless such sewage is first passed through a septic tank or filter bed. A year is allowed for the installation of septic tanks or filter beds. The general enforcement of this resolution would mean immense expenditures to the larger cities in the state, particularly St. Paul and Minneapolis. The sewage and surface drainage of both these cities are carried through the same pipes to the river. If the installation of filter beds is required it will mean the construction of entire new sewerage systems. The resolution applies to rivers within the state, and at St. Paul and Minneapolis the Mississippi River is such a river, but at Winona it it a boundary line between two states, and it is believed that the resolution would not be applicable to that city.

A Proposed New York State Board of Water and Sewer Commissioners.

A bill has been introduced in the New York Legislature providing for the placing of the water supply and sewer systems of the various cities and towns of that state under the control of a state board, similar in makeup and powers to the state railroad commission. The purpose of the bill is to create "The State Board of Water and Sewer Commissioners, to consist of three competent persons, who shall be appointed by the Governor by and with the consent of the Senate for a term of five years. One shall be a competent civil and hydraulic engineer and one a competent sanitary engineer and bacterioligist."

The salary of each commissioner is to be $8,000 and the board is to have a secretary at $3,500 and a marshal at $1,500, together with clerical force, inspectors, bacteriologists and chemists at a gross expense for salaries not to exceed $15,000 a year. The bill appropriates $75,000 to carout the provisions of the act.

To this commission is given almost ab-

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How Many Cities Remove Ashes and Refuse and the Cost.

Street Commissioner Pierson of Wilmington, Del., has been collecting comparative data of methods and cost of collecting ashes and rubbish in other cities. He recently sent letters to some of the principal cities and has received replies from twenty-eight of them giving the desired information. Data compiled from these letters, which included the practice followed in Wilmington, are as follows:

Wilmington—Population, 76,508. The city removes rubbish incidental to housekeeping, paper if tied up in bundles, but does not remove factory ashes. The carts are owned by the city and horses are hired by the day. The collections are made from the curb, once a week. The cost is $8,209.46 per annum, based on last year's cost, or 10 cents per capita.

Baltimore, Md.—Population, 508,957. The city removes the ashes and all household waste, including paper from dwelling and apartment houses. This does not include the ashes from factories, bakeries and steam boilers. The work is done by contract, and the collections are made from both yard and streets, three times a week. The cost for removing ashes and garbage is $195,800 per annum, or 32 cents per capita.

Boston, Mass.—Population, 560,892. The city removes all rubbish incidental to housekeeping and newspapers if tied in bundles; 10 cents per barrel extra being charged for removing ashes from factories, etc. The city owns most of the teams, but the work in the suburbs is done by contract. Collections are made only from yards; twice a week in winter and once a week in summer. The cost is $384,018.45 per annum, a per capita of 68 cents.

Buffalo, N. Y.—Population, 352,219. The city removes general household refuse and newspapers if the latter are kept separate. It does not remove factory ashes. The work is done by contract and is gathered from yards, if necessary. Collections are made twice a week from May to November and once a week from November until May. Collections are made in business sections daily. The cost is $81,705.34, or 21 cents per capita.

Cincinnati, O.—Population, 325,902. The city removes the ashes from dwellings, but does not remove factory ashes. The work is done by contract and the ashes are removed from streets and alleys two and three times per week at a cost of $103,000.

Columbus, O.—Population, 125,560. The city does not remove ashes, rubbish or paper.

Cleveland, O.—Population, 381,768. The city does not remove ashes or rubbish.

Chicago, Ill.—Population, 1,698,595. The ashes and household rubbish, outside of garbage, are removed by the city. Only such papers as are thrown out with other rubbish are taken. Factory ashes are removed at owner's expense. The city hires teams by the day, and collects from both yards and streets, weekly, semi-weekly and tri-weekly; business sections, daily. For ashes and garbage the cost is $645,000, which is 32 cents per capita.

Detroit, Mich.—Population, 285,704. The city collects all rubbish incidental to housekeeping, including newspapers. It does not remove factory ashes. The city hires teams by the day, and gathers from alleys or lanes which run between the streets. The collections are made in the residence sections twice yearly, and in the business and rooming-house sections as often as they beomce a nuisance. The expense is paid out of the street cleaning fund and is not made a separate acocunt.

Elizabeth, N. J.—Population, 52,130. The collection af ashes is made by the city by contract. The ashes and rubbish are taken from the sidewalks weekly at a cost of $7,100.

Hartford, Conn.—Population, 79,850. The city removes the ashes and rubbish, which includes general household rubbish and paper tied in bundles; does not remove factory ashes. The work is done by contract, and the collections are made from the sidewalks, onec a week in residenec sections and twice a week in business sections. For ashes and garbage the annual cost is $20,547.

Indianapolis, Ind.—Population, 169,164. The city does not remove the ashes.

Newark, N. J.—Population, 246,070. The city removes the ashes and rubbish, including paper. It does not remove factory ashes. The work is done by contract, the collections being made from sidewalks. The cost for removing ashes and garbage is $79,164 per annum.

New York City, N. Y.—Population, 3,437,202. The city removes the ashes and rubbish. By hanging out special cards the city calls for household refuse and removes same in special wagons. It removes bundles of paper and sells it, but does not remove factory ashes. The work is done by contract.

Philadelphia, Pa.—Population, 1,293,697. The city removes ashes and household waste; also newspapers. The work is done by contract, the collections are made from the streets weekly, and costs, including the cleaning of the streets, $693,850.

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Paterson, N. J.—Population, 105,171. The city removes household rubbish and a limited amount of waste paper; but does not remove factory ashes. The work is done by contract; collections are made from the curb weekly. The collection of ashes and garbage costs $30,000.

Richmond, Va.—Population, 85,000. The city removes rubbish of every description, including waste paper; but only a few newspapers are taken. The work is done by contract and collections are made from two to three times weekly from streets and alleys. Street cleaning, ashes and garbage cost $69,056, which is 69 cents per capita.

Rochester, N. Y.—Population, 162,435. The city removes all rubbish, all kinds of waste paper and factory ashes. Private teams are hired, paid per load for four yards, according to distance. The ashes are collected from yards, daily, semi-weekly and weekly. The cost is $80,000.

Syracuse, N. Y.—Population, 108,374. The city removes all household rubbish, newspapers in small bundles, but does not remove factory ashes. The city hires teams and collections are made from the streets every day in the centre of the city and every week in outlying districts. The cost is $20,000, which is 17 cents per capita.

Trenton, N. J.—Population, 73,307. The city removes houshold rubbish and waste paper, but does not remove factory ashes. The work is done by contract and collections are made from streets and alleys every other day. The cost is $20,000.

Washington, D. C.—Population 278,718. The district removes miscellaneous refuse and waste paper, but does not remove factory ashes. The work is done by contract. Rubbish is kept on premises until called for by contractor once a week. The cost is as follows. As..es, $29,979; refuse, $8,000; total, $39,979, which is 14 cents per capita.

Albany, N. Y., 94,151 population; Columbus, O., 125,560; Cleveland, O., 381,768; Indianapolis, Ind., 169,164; New Haven, Conn., 108,027; Providence, R. I., 175,597; Reading, Pa., 78,961; St. Louis, Mo., 575,-238;Toledo, O., 131,822; Scranton, Pa., 102,-026; and Pittsburg, Pa., 321,606;, do not remove the ashes. In Pittsburg natural gas forms the greatest part of fuel, and, consequently, there is a scarcity of ashes

joint garbage committees of the Council and Board of Health at Grand Rapids, Mich., brought forth considerable interesting and valuable information on garbage collection from fifteen cities. In twelve cities the garbage is collected in wagons, two in barrels, one in boxes and none in cans. In nine of the cities the garbage is collected by contract, and the city collects it in the other six cities. Householders own their own cans in twelve cities, and no statement is made regarding this in the other three. Disposal of garbage by cremation is followed by five cities, including Minneapolis, Syracuse, N. Y.; Columbus, O., and Milwaukee. Reduction is used in Utica, N. Y., population 56,383; Buffalo, N. Y., 352,-387; Detroit, Mich., 285,704.

In Worcester, Mass., whose population is 125,000, the garbage is collected from the entire city in wagons by contract, and is hauled to the poor farm, where it is fed to the hogs owned by the city. The following statement for 1903 is given:

Cost of collection	$18,140 57
Receipts from pork	11,941 55
Net expense	6,199 02

Other cities with populations given, report the following receipts in 1901 from the sale of garbage:

Lowell	94,969	$2,833 40
Cambridge	91,886	8,016 17
Lynn	68,513	3,788 82
Springfield	62,059	1,333 53

Toledo, 131,822, and Syracuse, 108,374, collect the garbage by the city, from 20,-000 houses in each city at a cost of $14,-000 and $20,000 respectively.

Cincinnati's Exclusive Garbage Contract Ordinance Invalid.

A decision was rendered by the Circuit Court at Cincinnati, Jan. 19, declaring invalid the ordinance regarding the hauling of garbage through the streets. The decision was rendered in the habeas corpus proceedings of David Bauer against James Casey, inspector of police, and others. The plaintiff was arrested on the charge of hauling garbage through the streets, and was fined $50 and costs in Police Court. He attacked the validity of the ordinance and the lower courts

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Circuit Court, and there they won their contention that the lower court had no right or authority to seperate the ordinance. The Circuit Court took this view of the case and held that the assumption of the lower court that the Board of Legislation had omitted unintentionally a vital part of the ordinance, was untenable. The ordinance is, therefore, declared invalid.

CEMENT AND CONCRETE

Concrete Foundation and Cement Filler for Brick Pavement—Concrete Masonry—Concrete—Cinder Concrete in Baltimore Fire.

Concrete Foundation and Cement Filler for Brick Pavement.*

By. O. L. Gearhart, City Engineer, Champaign, Ill.

In this paper it is proposed to discuss the economic relations between concrete foundations of different compositions and cement filler.

The Concrete.—About a year ago the writer made a series of experiments to determine the variation in the strength and cost of concrete d ue to a variation in the kind of cement and in the proportions of the ingredients. The former practice was to use a natural cement concrete for the pavement foundation, but on one occasion the Portland cement concrete, consisting of one part Portland cement and nine parts fine gravel, was used with excellent result. This led the writer to give the matter of Portland cement concrete further study.

The numbers of specimens made were about as follows : Twenty-five 8-inch cubes, twenty-five 6-inch cubes and twenty-five 6x6x21½-inch beams. Eleven different proportions with Portland cement and one proportion with natural cement were used. One each of the two cubes and one beam were tested at the two different ages, viz.: 30 days and 90 days. Owing to other matters that were occupying the writer's attention at that time the age for breaking specimens intended for the 90-day tests varies somewhat, but the difference is not enough to materially change the results. The different specimens were made by the writer at the Champaign City Laboratory, and through the kindness of Professor A. N. Talbot were tested on the machines belonging to the Department of Applied Mechanics at the University of Illinois. Only details essential to the understanding of the results will be mentioned here.

Materials.—The materials used were Atlas Portland cement, Clark's Utica cement, gravel from a pit northwest of Urbana, Ill., sand from a bank in the same locality and broken stone from a quarry at Kankakee, Ill. The sand was a fair quality of building sand containing some clay and having about 35 per cent. of voids. Of the gravel 23 per cent. was retained on a No. 4 sieve, 53 per cent. on a No. 10 sieve, 71 per cent. on a No. 20 sieve and 29 per cent. passed a No. 20 sieve. This material contained 21 per cent. voids. It will be seen that the gravel contained but lit'le coarse material. The broken stone was a good quality of stratified limestone, crushed so that all of the particles would pass a screen of two-inch mesh and be retained on a screen of one-half-inch mesh. This material contained 4 per cent. voids. The stone is bought by weight, and as the freight is quite an item it is found to be cheaper in Champaign to buy screened stone and fill the voids with a larger amount of gravel than would otherwise be necessary.

The cement was taken from bags shipped to this city for the retail market and was not a special cement for testing purposes. It will be seen that the Utica cement is a very high grade of natural cement and that the Atlas cement is a good quality of Portland. The fineness of the cement is as follows:

	Utica.	Atlas.
Per cent. passing sieve No. 50	97.4	99.6
Per cent. passing sieve No. 100	80.5	92.5

The activity of the cement is as follows:

	Utica.	Atlas.
Time from mixing to initial set	:32	1.56
Time from mixing to final set	3:20	5:16

*A paper before the Illinois Society of Engineers and Surveyors.

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The tensile strength of the cement in pounds per square inch is as follows:

Cement.	Per Cent. of Water.	Age.		
		24 hrs.	7 ds.	30 ds.
Utica.....	31	80	181	230
Atlas.....	17	265	710	.....

Mixing and Testing.—The cement and gravel were thoroughly mixed dry, then wetted and mixed into a stiff mortar, after which the dampened stone was added and the whole was turned several times. The mixture was then tamped into the molds by means of an eleven-pound tamper, having a face area of nine square inches. About two or three inches of loose material was placed in the molds at a time and tamped. During the operation a square-ended trowel was worked up and down between the concrete and form, thus bringing the mortar to the sides and corners of the specimen and making it homogenous throughout. In every case only enough water was used to cause a film of water to come to the surface after considerable tamping. The cubes were left in the molds for twenty-four hours with a damp cloth over them, after which time the molds were carefully removed and the specimens were stored under cloths, which were dampened from time to time until the cubes were tested. The concrete beams were made and stored in the same manner as the cubes.

In crushing the cubes and breaking the beams, the direction of the force applied was perpendicular to the tamped surface. Immediately before crushing the cubes the two faces to which the force was applied were plastered with a thin coat of plaster of Paris and a self-adjusting plate was used to distribute the pressure over the entire surface of the cube.

Costs.—In arriving at the cost of the concrete, gravel and sand were taken at 90 cents per cubic yard, broken stone at $1.40, Utica cement at 65 cents per barrel, Portland cement at $2, and labor for measuring, mixing, placing, grading and tamping a six-inch layer of concrete was taken at 6 cents per square yard.

Results.—Table I shows the strength of the cubes and beams and also gives the yield of rammed concrete in terms of the sum of the volumes of the gravel and broken stone. This table also shows the cost per square yard of a six-inch layer of concrete of the different compositions.

Conclusions.—From the tests given in tabe I, it is believed that the following conclusions may be drawn:

TABLE I.

STRENGTH AND COST OF CONCRETE OF DIFFERENT COMPOSITIONS.

No.	Proportions.				Yield in terms of volumes of gravel and broken stone.	Age, days.	Load on cubes, lbs. per sq. in.		Average crushing strength, lbs. per sq. in.	6"x6"x18" beams.		Cost per sq. yd. for depth of 6", cents.
	Cement.	Sand.	Gravel.	Broken stone.			8"	6"		Load at center, lbs.	Modulus of rupture, lbs. per sq. in.	
NATURAL CEMENT.												
1	1	.....	3	3	.....	30	610	540	575	1280	160	.....
2	1	.....	3	3	77 %	90	870	470	670	1270	159	49
PORTLAND CEMENT.												
3	1	.....	5	.....	80.4%	30	1750	1565	1657	2700	388	77.5
4	1	.....	5	.....	.....	90	1770	1990	1880	3060	382	.....
5	1	.....	4	4	74 %	30	1500	1365	1432	2440	305	74.6
6	1	.....	4	4	.....	90	2210	1780	1995	5360	670	.....
7	1	.....	6	4	70.7%	30	1180	1170	1175	1800	225	68.6
8	1	.....	6	4	.....	90	1260	1430	1345	1620	203	.....
9	1	.....	5	5	74.4%	30	2250	1545	1897	2800	350	66.1
10	1	.....	5	5	.....	90	1850	2050	1950	3290	410	.....
11	1	.....	8	4	72.8%	30	890	840	865	1650	206	57
12	1	.....	8	4	.....	105	883	1230	1056	2500	313	.....
13	1	.....	6	6	76 %	30	1290	895	1092	2550	319	64
14	1	.....	6	6	.....	90	1510	980	1220	3060	383	.....
15	1	.....	8	6	74 %	30	965	570	767	1750	219	56.8
16	1	.....	8	6	.....	115	1425	860	1142	1700	213	.....
17	1	.....	7	7	74 %	30	1240	1365	1302	2100	263	56.6
18	1	.....	7	7	.....	90	1190	1425	1307	2820	353	.....
19	1	.....	8	8	73 %	30	1010	990	1000	1600	200	51.4
20	1	.....	8	8	.....	108	1050	1030	1040	1930	241	.....
21	1	.....	10	10	71.5%	30	530	600	565	1010	126	50.3
22	1	.....	10	10	.....	118	585	.....	.....	1220	153	.....
23	1	.....	10	10	.....	102	.....	610	.....	.....	.....	.....
24	1	6	.....	6	.....	30	1230	*780	1230	1780	223	.....
25	1	6	.....	6	.....	107	1720	1535	1627	2410	301	.....
26	1	.....	8	16	†70 %	.....	.....	.....	.....	.....	.....	51

*Defective and omitted from average. †Assumed.

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1. From numbers 2 and 20 in table I, we see that the cost of Portland cement concrete is about 4 per cent. more than natural cement concrete, while the former is 50 per cent. stronger.

2. By comparing numbers 2 with 23 and 24, it is seen that the strengths of concrete composed of 1 part natural cement, 3 parts gravel and 3 parts broken stone, and concrete composed of 1 part Portland cement, 10 parts gravel and 10 parts broken stone, are nearly equal.

3. By comparing experiment number 4 with number 10, it is seen that the addition of broken stone in amount equal to the gravel, without increasing the quantity of cement, materially increases the strength and decreases the cost of the concrete.

4. Numbers 12, 16 and 20 show that the increase of the broken stone from four parts to eight parts does not materially change the strength of the concrete, but reduces the cost.

Table II shows the result obtained by supporting the beams on knife edges 24 inches apart and applying the load at the center.

By comparing number 2 and number 20 in Table I with number 3 in Table II it will be seen that a brick beam four inches in depth is 50 per cent. stronger than a concrete beam consisting of one part natural cement, three parts gravel, and three parts broken stone, and is also a little stronger than a beam consisting of one part Portland cement, eight parts gravel, and eight parts broken stone. This fact suggests the idea whether it may not be economical to employ the cement as a filler between the brick rather than using it in the concrete foundation.

The cost of the cement and labor for a six-inch layer of concrete composed of one part Portland cement, eight parts gravel, and eight parts broken stone is about twenty-four cents per square yard more than that of a compacted layer of gravel or broken stone; and the cost of the cement filler is about six to ten cents per square yard more than sand filler. Therefore a brick pavement with cement filler on a foundation of broken stone or gravel without any cement in it is from 14 to 18 cents per square yard cheaper than brick pavement with a sand filler and with a concrete foundation; and further, the two forms of construction are of equal strength.

For a pavement on a street which has been cut up with trenches and where the filler adds very much to the strength and to the life of the improvement, the added expenditure for the filler is money well invested. In residence districts, where the traffic is not so heavy or constant, a brick pavement with cement filler and a gravel foundation may be constructed with advantage and the cost of

TABLE II.

MODULUS OF RUPTURE OF BRICK BEAMS WITH CEMENT FILLER.

No.	Filler.		Name of Brick.	Age Days.	Dimensions of Beam in Inches.			Load at Center, Lbs.	Modulus of Rupture, Lbs. Per Sq. In.	Beam 6"x4",18" Span, Load at Center, Lbs.	Cost of Filler Per Sq. Yd. Cents.
	Cement.	Sand.			Depth.	Breadth.	Length.				
1	1	1	Clinton.	30	4	10⅛	24	1640	351	1248	8 to 12
2	1	1	"	30	4	10⅜	24	2160	452	1607	"
3	1	1	"	90	4	10⅜	24	2660	557	1981	"
4	1	1	Culver.	30	4	11	24	2570	526	1870	"
5	1	1	Poston.	122	4	11	24	2210	452	1607	"

5. By comparing numbers 18 with 26, it is seen that the increase of the broken stone from eight parts to sixteen parts does not materially change the cost of the concrete.

6. About half a mile of pavement having a very lean Portland concrete was laid during the past season under the writer's direction. It was found, much to the surprise of the writer, and also to the contractor, that not only the very lean concrete was more easily mixed, but it was more uniform than the very rich natural cement concrete, heretofore used.

In all respects the Portland cement concrete is superior to the natural cement concrete.

Brick Beams.—The writer made a number of brick beams by taking paving brick and cementing them together with a cement filler. The beams were three bricks long, three bricks wide and four inches deep. They were formed by laying the brick side by side as in the pavement, and the interstices were filled with grout consisting of one part Portland cement and one part sand.

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the improvement be considerably less than if a concrete foundation and sand filler be used.

As far as the writer knows, attention has not before been called to the strength produced by the cement filler, nor the fact that the brick thus filled makes the beam 50 per cent. stronger than the use of concrete foundation; and in view of what has been said concerning strength of the cement filler, to use it in pavement construction is clearly an economical advantage.

For several valuable suggestions, the write gratefully acknowledges his indebtedness to Prof. A. N. Talbott and Prof. I. O. Baker.

Concrete Masonry with Special Reference to the Use of Natural Bank Gravel.*

By George S. Pierson, M. Am. Soc. C. E., Kalamazoo, Mich.

The varied uses to which concrete is put demand different mixtures. In some cases, a concrete with but a small proportion of cement and which requires no surface finish will answer the purpose. In other cases strength is the important consideration, in others a smooth surface finish, and abrasion; b concrete is sults shoul

One of t concrete ma igan has m and sand f may be ma found near the very e the structu cur contain proportions times the n better and concrete th specificatio cause in t material w lated in a compact an tion of void be improve considerabl proportion or of coars and consid saved with of masonry

The write

MECHANICAL ANALYSIS OF NATURAL B

	No. 1. %		No. 2. %		
Screen.	Ret'd.	Diff.	Ret'd.	Diff.	Re
1½ inch	8.0	8.0			
1 inch	21.7	13.7	4.9	4.9	1
¾ inch	31.7	10.0	9.5	4.6	1
½ inch	44.0	12.3	15.3	5.8	1
⅜ inch	59.4	15.4	27.5	12.2	3
⅛ inch	68.8	9.4	38.1	10.6	4
¹⁄₁₀ inch	70.8	2.0	41.4	3.3	4
¹⁄₂₀ inch	79.6	8.8	61.8	20.4	6
¹⁄₃₀ inch	96.4	16.8	95.5	33.7	9
¹⁄₄₀ inch	99.0	2.6	97.6	2.1	9
		1.0		2.4	
		100.%		100.%	
Voids, loose	25 %		28.5%		

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and construction of a concrete waste weir last season, and as the price of cement was high at the time and the material for the aggregate must be brought from a distance, it seemed worth while to make a more than usually careful examination of material which could be secured for an aggregate. Samples were taken from several deposits and analyzed with the result shown below.

It is difficult to secure a fair sample from the face of a pit where the gravel is sloughing and running down the face, as the coarser particles are separated and carried farther down the slope. The material also varies in composition as it lies in most pits and must vary somewhat as it is delivered for use on the work. This objection is not peculiar to natural bank gravel, however. The same objection may be urged against the crushed stone often used as an ingredient of the aggregate, and against the sand used with it. Although it is improbable that the analyses represent precisely the conditions of the aggregate as it is received on the work, a comparison of the analyses with each other and with the samples to which they refer appears to be of considerable assistance in deciding the relative value of material from different deposits, and in detecting variations in the quality of material as it is delivered.

Sample No. 1 contains excellent material, but the sample indicates that the addition of quite a proportion of coarse sand would result in a stronger and more impervious concrete, a smoother finish and saving in cement.

Sample No. 2 is poorest of all. It contains too small a proportion of large particles, too great a proportion of fine sand, and some clay. The voids in it are greater than in any of the others and the weight per cubic foot and also the specific gravity of the particles, less than in any of the other samples.

Sample No. 3 contains too small a proportion of coarse particles for economy.

Sample No. 4 contains a larger proportion of particles from one-eighth-inch to one-half-inch than any of the other samples. Probably a larger proportion of sizes three-fourths inch to one inch would be desirable in massive work and require less cement, though probably not as smooth a finish could be obtained. The voids in this sample were less than in any of the others examined, the weight per cubic foot greatest, and the specific gravity of the particles highest. This material was fairly accessible. Tests of the material were made frequently during construction and it was found that the addition of a small proportion of a rather fine, gray sand, which was found in the excavation, slightly reduced the voids and made a smoother finish next the forms.

The voids in all the samples were measured with the material dry and loose. As placed in the work the voids would, of course, be much less.

A convenient rule for determining approximately the voids in gravels, one which can be conveniently applied in the field, is the following: I have found that the natural gravels in this vicinity have an average specific gravity of about 2.65. This corresponds to a weight per cubic foot, if there were no voids, of 166 pounds. If a known measure of gravel be weighed and its actual weight per cubic foot ascertained, then the voids in the condition in which it was weighed will be: Per cent. of voids equals 166, minus weight per cubic foot, divided by 166.

Gravels differ considerably in the character of the particles. Some are made up of well-rounded and smooth particles, and in some the particles are more angular and the surface rougher, which is advantageous.

Under a compound microscope with one-inch objective the sand and fine gravel in sample No. 4 seems sharper than in any other of the samples, with No. 1, No. 3 and No. 2 following in the order named. The gravel in sample No. 3 seems roughened by fine sand particles which adhere to the surface, and this would probably give a better adhesion to the matrix.

Probably natural bank gravels as they are taken from the pit or mixed with small proportions of fine or coarse material as a corrective, can be used in concrete to better advantage than they usually are. This material can be selected or mixed so as to adapt the concrete to a wide range of uses, from rough and massive work to work which is light and finished in mould which require sharp and perfect details. The labor which can be judiciously spent in selecting or balancing the aggregate will be determined by the current price of cement and the use to which the concrete is put.

Concrete.*

By S. B. Newberry, Sandusky, O.

Concrete is a compact mass composed of sand and broken stone or gravel, united by cement.

Hydraulic cement concrete has been known since an early period of history. It is, however, only since Portland cement has been cheaply produced and greatly

*From a paper before the Indiana Engineering Society.

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improved in quality and uniformity that concrete construction has attracted the attention of engineers. At the present day Portland cement concrete is being adopted with astonishing rapidity in all kinds of constructions in place of stone, brick, wood and iron. Portland cement is the essence of rock in portable form. When judiciously used it will convert many times its volume of loose sand, gravel and waste stone into a solid brick or monolith, of any desired shape, equal in strength and durability to the best rock from the quarry. It is not surprising that a material which will do this should be in great demand.

Materials. — Sand should be clean and sharp. The sands which give the highest tests with cement are those showing rounded grains with a dull surface. A mixed size of grain, from fine to coarse, is better than a grain of uniform size. The presence of a small amount of clay, up to 4 or 5 per cent., does not harm if concrete be thoroughly mixed and sufficiently wet.

Gravel and broken stone should be hard and sharp, and as free as possible from soft particles. The harder the stone the better the concrete will be; trap rock or crushed flint or quartz are superior to soft limestone or sandstone. As in the case of sand, a mixed material, fine to coarse, is preferable, and screening is generally injurious. It was formerly supposed that the presence of fine dust in the materials was objectionable. This is not the case if the mixing be thorough. It is quite possible that with imperfect mixing a film of clay or stone-dust might coat the stone or gravel and prevent adhesion of the cement. If the mixing be thorough, however, these fine materials will help to fill the voids and increase the strength. The most competent engineers now use crushed stone without screening, containing all the dust from the crusher.

Many engineers consider broken stone superior to gravel for concrete. With this view the writer does not agree. Good quartz gravel is harder than any broken stone except trap or quartzite. gravel show that where good, coarse gravel is abundant there is no need of going to a distance for a supply of costly crushed stone.

Proportions. — The chief object in compounding concrete is to produce a compact mass, as free as possible from pores or open spaces; in short to imitate solid rock as closely as possible. To produce a compact mass from fragmentary materials the voids must be filled. Imagine a box holding one cubic foot. If this were filled with spheres of uniform size, the voids or open spaces would be 25.95 per cent. of the total volume. With spheres of various sizes, as, for example, from large marbles down to small shot, the voids would be much less, and it would theoretically be possible, by the use of spheres of graded sizes, from the largest down to dust of infinite fineness, to fill the box completely, so that there should be no voids whatever. In practice it is well known that the use of materials of varying fineness gives the best concrete, since the voids are much less than in materials composed of pieces of uniform size. Hence the common practice of making concrete with cement, sand and broken stone, instead of stone only. The sand fills the voids of the stone, the cement fills the voids of the sand, and if the proportions are correct a practically solid mass results. As an example of this, the writer found that briquettes of cement with three parts sand and four parts gravel showed higher tensile strength at twenty-eight days than those made with three parts sand only.

The determination of the percentage of voids in the gravel or broken stone to be used is of the greatest importance. This determination is most easily made by the use of a metal box of exactly 1 cubic foot (or a known part of a cubic foot) capacity. This is weighed, filled with the material, well shaken down, and again weighed. Now, quartz sand or limestone (carbonate of lime) has a specific gravity of 2.65. One cubic foot of solid quartz or limestone, free from voids or pores, would therefore weigh 2.65 times as much as a

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	Per cent.
Sandusky Bay sand, not screened....	32.2
Sandusky Bay sand, through 20 mesh.	38.5
Sandusky Bay, 20-30 mesh.....	40.7
Gravel, ¼ to ⅛ inch.....	42.4
Gravel, ¼ to 1-20 inch.....	35.9
Marblehead broken stone, about egg size	47.0

Comparison of the three different grades of Sandusky Bay sand shows how greatly the percentage of voids varies with the proportion of fine and coarse grains present. The first is the natural sand, not screened, as pumped up by the sand-sucker from the bottom of the bay, and contains a large amount of fine gravel. The second is the same, passed through a 20-mesh screen to remove the coarse particles. It will be seen that this operation increases the proportion of voids from 32 to 38 per cent. The third is the same sand, passing a 20-mesh and retained on a 30-mesh screen, thus brought to the fineness of the "standard sand" used in cement testing. This shows 40.7 per cent. of voids, owing to the uniform size of the grains. The same relation is seen in the two grades of gravel given in the table, that containing finer grains showing much the lower percentage of voids. These figures illustrate the imprudence of screening any of the materials used in making concrete.

As an aid in determining the voids in concrete materials, the writer has prepared the following table, in which the percentages of voids corresponding to various weights per cubic foot may be seen at a glance. The figures given in this table are calculated on the assumption that the specific gravity of sand, gravel and stone is 2.65.

Table showing weight per cubic foot and per cent. voids in sand, gravel and broken stone.

Wt. per cu. ft.	Per cent. voids.	Wt. per cu. ft.	Per cent. voids.	Wt. per cu. ft.	Per cent. voids.
165.4	0.00	135	18.38	105	36.52
164	.85	134	18.98	104	37.12
163	1.45	133	19.58	103	37.73
162	2.06	132	20.19	102	38.33
161	2.66	131	20.80	101	38.94
160	3.26	130	21.40	100	39.54
159	3.87	129	22.01	99	40.15
158	4.47	128	22.61	98	40.75
157	5.08	127	23.22	97	41.35
156	5.68	126	23.82	96	41.96
155	6.29	125	24.43	95	42.56
154	6.89	124	25.03	94	43.17
153	7.50	123	25.63	93	43.77
152	8.10	122	26.24	92	44.38
151	8.71	121	26.84	91	44.98
150	9.31	120	27.45	90	45.59
149	9.92	119	28.05	89	46.19
148	10.52	118	28.66	88	46.80
147	11.13	117	29.26	87	47.40
146	11.73	116	29.87	86	48.00
145	12.33	115	30.47	85	48.61
144	12.94	114	31.08	84	49.21
143	13.54	113	31.68	83	49.82
142	14.15	112	32.28	82	50.42
141	14.75	111	32.89	81	51.03
140	15.36	110	33.49	80	51.63
139	15.96	109	34.10	79	52.24
138	16.57	108	34.70	78	52.84
137	17.17	107	35.31	77	53.45
136	17.78	106	35.91	76	54.05

Having determined the voids in the sand and gravel and stone, let us next inquire how we shall calculate the proportions in which the materials are to be used. At first glance it might be supposed that the larger the proportion of cement a concrete contains, the stronger it will be. This is by no means necessarily the case, as the following table, taken from a paper by Dykerhoff, clearly shows. This table gives the crushing strength of various concretes, determined by tests of 2½-inch cubes after 1 day in air and 27 days in water.

Proportions by Measure.			Strength under compression. Pounds per sq. inch.
Portland Cement.	Sand.	Gravel.	
1	2	.....	2,125
1	2	3	2,747
1	2	5	2,387
1	.....	5	978
1	3	.....	1,383
1	3	5	1,682
1	3	6½	1,515
1	4	.....	1,053
1	4	5	1,273
1	4	8½	1,204

These figures prove that mixtures of cement and sand are strengthened rather than weakened, by the addition of a suitable quantity of gravel. It will be noticed that the mixture—cement 1, sand 2, gravel 5—is actually stronger than cement 1, sand 2, without gravel. The same is shown in the mixtures 1 to 3 and 1 to 4. Again, the last mixture, 1:4: 8½, containing only 7.4 per cent. cement is stronger than the mixture 1:4, containing 20 per cent. cement. One barrel of cement, judiciously mixed with sand and gravel, is therefore as good as 3 barrels used with sand only.

As to the proportion in which the materials are to be mixed to give the best result, Mr. Wm. B. Fuller (Proc. Am. Soc. Civil Engrs. Dec. 1899) points out that "there is one proportion, and only one, in which a given sand and stone can be mixed and give the minimum of voids;

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this is the proportion in which they should always be mixed, whether a rich or poor concrete be desired."

Mr. Fuller's rule is:

"Mix the sand and stone (or gravel) in a definite fixed quantity for the material in use, and add cement as economy dictates, possibly up to 10 per cent. in excess of the voids in the combined material."

To determine the practical value of this rule, the writer made experiments with the following materials:

	Wt. Per Cu. ft.	Per Ct. Voids.
Gravel, about 1 in. in size	101.2 lbs.	38.7
Sand, 20 to 40 mesh	105.8 "	35.9
Cement, Medusa	114.5 "	....

The weights of these materials were determined by filling a metal cylinder of a measured fraction of a cubic foot capacity.

Since the gravel contains 38.7 per cent. voids, we shall require 38.7 per cent of a cubic foot of sand to fill these voids. If the materials could be perfectly mixed, the sand would exactly fill the voids in the gravel, and the mixture would weigh 142.1 lbs. per cubic foot, and would contain 38.7 times 35.9 divided by 100, or 13.9 per cent. of voids.

Mixtures in this proportion, and with greater quantity of sand, were made and the volume-weight determined with following results:

	Wt. Per Cu. ft.	Per Ct. Voids.
Gravel, 38.7 per cent. sand	133.5	19.2
Gravel, 50 per cent. sand	133.7	19.1
Gravel, 60 per cent. sand	131.2	20.5

It will be noted that increase of the sand from the calculated volume, 38.7 per cent. to 50 per cent., makes practically no difference in the density, while further increase to 60 per cent. increases the voids and injures the mixture.

Further tests of the same materials were made, with the addition of the volume of cement necessary to fill the calculated voids in the mixed sand and gravel. The results were:

		Wt. per cu. ft.	% Voids
Gravel	+ 30% sand + 13.9% cement	137.9	16.5
"	+ 38.7% " + 13.9%	142.5	13.7
"	+ 50% " + 13.9%	140.7	14.8

These figures show strikingly that the calculated proportion of sand gives greater density than a greater or less amount

This will vary considerably with different materials, but those materials are certainly best which when mixed in the most favorable proportions give the greatest weight per cubic foot. Any good gravel and sand, rightly proportioned, will show at least 130 pounds; the best result the writer has ever obtained was 139 pounds, corresponding to 15 per cent. voids. Broken limestone and sand give less density, rarely more than 125 pounds per foot. A few trials with available materials will enable an engineer to specify a minimum weight per cubic foot for materials to be used in a given piece of work.

Proportion of Cement.—Mr. Fuller's rule, stated above, is to "add cement as economy dictates, possibly up to 10 per cent. in excess of the voids in the combined material." The lowest proportion of voids obtained with the gravel and sand used in the above experiments was 19.1 per cent. Addition of this proportion of cement would give a very rich and expensive concrete; about 1 to 5, far beyond anything that could be required for any use except water-tight work. On the other hand, if a volume of cement equal to the calculated voids in the mixture,—13.9 per cent.,—be taken, we shall have 1:7 concrete, of abundant strength for engine foundations or other important uses. Mixtures much poorer in cement, containing 10 per cent. or even 7 per cent. may safely be used for foundations, filling of abutments, etc. If the materials are well selected and correctly proportioned these poor concretes will be found to have surprising strength, and often to be superior to rich mixtures injudiciously combined.

Many series of tests of strength of concrete have been published, but in none of them, so far as we know, have the influence of proportions on density and density on strength, been clearly stated. Such a series of experiments, consisting of crushing tests of 6 cubes of concrete is now in progress under the writer's direction, and results will be published as soon as complete. It is believed that the strength of concrete will be found to be more or less closely proportional to the ratio of percentage of cement to voids, and that mixtures in which the voids are filled to the same degree will be approximately equal in strength. There is, how-

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It is probably chiefly for this reason that coarse materials give greater strength than fine materials.

To sum up the foregoing reasoning in regard to the composition of concrete, we may formulate the following rule for obtaining the best practical results. This is simply an extension of Mr. Fuller's instructions:

Determine carefully the voids in the gravel or broken stone which it is proposed to use; add finer material in the proportion necessary to fill the voids, also in greater and less proportions, and adopt the mixture giving the greatest weight per unit of volume. Add cement in amount depending on desired strength and admissible cost, from a minimum of perhaps 7 per cent. to a maximum equal to the total volume of voids in the mixed materials.

Proportion of Water.—It was formerly supposed that the best concrete was obtained by using very little water, and engineers generally specified that the consistency of the mixture should be that of moist garden earth, and that no water should show until thoroughly tamped. Recently it has been shown that the use of more water—at least enough to make the mass decidedly plastic—gives better results. A paper by Irving Hitz (J. of Western Soc. of Engineers, January, 1901), describes experiments on this point by engineers of the C., M. & St. P. Railway. Three-foot cubes of cement, gravel and stone were prepared, using water to the amount of 44 per cent. and 82 per cent. of the volume of the cement, respectively. The first mixture was merely damp, and was compacted in the box by tamping. The second mixture was liquid, and was poured into the mold without tamping. After thirty days the wet cube was found to be 9.7 per cent. heavier than the dry, and was smooth and dense on the surface, while the dryer cube was rough and porous. On splitting the blocks the wet cube proved to be much harder, and most of the stones were broken along the line of fracture. The dry block, on the other hand, gave an irregular break, most of the stones remaining whole, and the mass showed distinct layers corresponding to the different batches of material.

Another valuable paper on this subject is that by Parkhurst, chief engineer Illinois Central Railroad, in J. West. Soc. Engrs., June, 1902. Dry concrete was found to weigh 136.2 lbs. per cu. ft., medium 151.5 lbs., and wet, 151.4 lbs. The dry blocks easily crumbled in handling. On splitting, the medium and wet blocks were found to be excellent; the dry block poor and not well compacted. Mr. Parkhurst recommends a medium proportion of water, such that the concrete shall quake when strongly rammed, but states that excess of water is better than deficiency.

In the discussion following Mr. Rafter's paper on the theory of concrete, (Proc. Am. Soc. Civil Engineers, Dec. 1899), Mr. Herman Conrow stated that he had found the cost of a wet concrete, laid in place, to be $4.13 per yard, and of dry concrete of the same composition $5.13 per yard. The use of a liberal proportion of water thus effected a saving of 24 per cent.

Mixing and Laying Concrete.—Engineers appear to be generally convinced of the advantage of using a suitable concrete-mixer, instead of hand labor. Where large amounts of concrete are to be mixed the saving by using a power mixer is very great, and there can be no doubt that the danger of imperfect and careless mixing is avoided by use of a suitable machine. The writer has successfully used mixers of the pug-mill type, consisting of a trough with revolving blades. Several excellent machines of the revolving-drum type are in use, and give excellent satisfaction. An ingenious horse-power machine is the "Dromedary mixer," made by the Fisher & Saxton Company of Washington, D. C. This consists of a drum mounted on wagon-wheels, in which the concrete is mixed while being transported to the place of use. For cement mortar, containing nothing coarser than fine gravel, to be thoroughly mixed in batches, the phosphate mixer, made by the Elliot & Walker Company of Wilmington, Del., may well be recommended. This is a revolving pan provided with rotating stirrers; it is very convenient and requires but little power.

In mixing concrete the sand and cement should first be mixed, dry, then the water added, and finally the stone or gravel, previously well wetted, is introduced and the whole thoroughly mixed together.

Large masses of concrete should be laid continuously, by day and night work if necessary, to avoid partings between set and fresh work. If the laying must be interrupted the set surface should be thoroughly wetted and dusted with cement before fresh concrete is applied. This method should also be used in plastering the surface of concrete with cement mortar. A break in a cement floor or sidewalk may be successfully patched in the same manner.

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Concrete in Freezing Weather.—Freezing does no harm to Portland cement after the mass has fully set. The hardening of the cement is interrupted by freezing, but proceeds again without hindrance after thawing takes place. Damage from frost is to be feared before the setting, especially if excess of water is used. When work in extreme cold can not be avoided, the sand and water should be warmed and the proportion of water reduced to a minimum. After putting in place the work should be covered with straw or other non-conductor to protect it from frost. Mortar for use in freezing weather is often made with the addition of salt (about one pound to one gallon of water) and appears to give good results. Cement plastering in extreme cold weather should not be attempted.

Concrete in the Baltimore Fire.

An engineer engaged in concrete construction reports to Municipal Engineering that the behavior of concrete in the Baltimore fire was in general very satisfactory. The fire-proof buildings, of which there were, under a strict classification, but six or eight, came through the fire practically intact and with comparatively little injury to contents. About as many incombustible buildings came through without serious injury, aside from wooden trimmings and partitions, but lost all their combustible contents, in some cases even those in vaults. Apparently most of these buildings had tile floors of some sort, but there were a few floors of reinforced cinder concrete. Nearly all the floors of both descriptions successfully withstood the fire. In several instances the tile floors were broken through by falling safes and other debris, but no failures of the concrete floors on this account were reported by our informant. In fact, the concrete roof of one three-story building successfully withstood the shock and weight of the falling walls of the adjoining higher building, and concrete floors in other buildings developed similar strength. The Commercial and Farmers' National Bank building was a notable instance of the efficacy of a concrete floor. The banking room on the ground floor, which had concrete floor and ceiling, was protected from injury although the roof and two upper floors of wooden construction were destroyed and the debris, including a safe which was on the fourth floor, fell on the concrete floor.

Reports of failures of concrete floors have not yet been reported, but the successes noted prove definitely the value of cinder concrete floors constructed according to the best designs. Their work shows them fully equal to tile floor in resisting fire and superior in strength to resist both shock and the weight of debris.

METHODS AND RESULTS

Grade Crossings in Detroit—Asphalt Bids for Detroit—California Oiled Roads—Convict Labor on Road Materials—Greater Asbury Park—Electric Power for N. Y. C. Railroad—Legislators and Iowa Municipal League—Small Parks for Chicago—Illinois Engineering School—Civil Service Examinations.

Grade Crossings on Dequindre-St. Detroit.

Plans providing for separating the heavy grade of the railroad tracks on Dequindre-st. and the hight of some of the streets present great difficulties. The plans provide for the depression of sev-

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sides of Dequindre-st. As nearly all of the subways will run to Orleans-st. or beyond, there will not only be depressions in the cross streets, but Orleans-st., the parallel street, will have to be depressed from 2½ to 3½ feet nearly the whole distance from Gratiot-ave. to Fort-st. Although the damages will be enormous, the committee, the city engineer and the railroad men feel that it is not only the sole practicable plan of grade separation, but that it is cheaper than it would be to depress the tracks and bridge the streets.

Detroit's Bids for Furnishing Asphalt.

The city of Detroit, Mich., received bids from nine firms, Feb. 1, for furnishing 1,500 tons of refined asphalt. The Barber Asphalt Paving Company offered to deliver Trinidad lake asphalt at $26, and the Venezuela at $23.90 a ton, which is the lowest price, it is claimed, ever submitted on these two brands. Otto Guelich offered a Turkish asphalt, which is controlled by a French syndicate, at $25 a ton. Los Angeles asphalt was offered at $20 a ton. The Trindad Asphalt Manufacturing Company of St. Louis bid on the crude material at $15,98 a ton, and included five grades of the refined material in its bids, varying from $18.98 to $27.98 a ton. The American Asphalt Rubber Company of Chicago offered asphalt which is 99 per cent. pure and will go 50 per cent. further than the Trinidad asphalt, at $23.50.

Success of California Oiled Roads.

A communication has been received by Clark Alberti, secretary of the department of highways at Sacramento, Cal., from Robert H. Reaney, district and road engineer at Wanganui, near Auckland, New Zealand, in which he states that his attention has been drawn to the successful experiments carried out in California in the construction of permanent road surfaces by the use of oil, and asking for detailed information as to the methods used, and any other facts which would be of service in establishing a similar system of oiled highways in New Zealand.

Secretary Alberti has been engaged for some time in compiling the latest available practical information on the construction and maintenance of oiled roads. Communications received from the supervisors of every county in California indicate that there will be a large increase in the mileage of oiled roads and streets during 1904. The California Department of Highways will later issue this matter in printed form and supply all the road officials in the state.

Convict Labor on Road Materials Proposed in Indiana.

In a recent address before the Farmers' State Congress of Indiana State Geologist Blatchley severely criticised the contract labor system now in force in the state prisons. His subject was, "The Utility of Convict Labor in Making Road Material," which he discussed, in part, as follows:

The contract labor system is a system which often leads to debauchery and corruption of public officers. It is a system that robs labor, destroys factories and turns over to private individuals an asset of labor which should be used for the benefit of the people. The law-breaker owes a debt to the community and any profits accruing from his labor should go to the community.

In order to abolish the evils in the contract system and to improve the roads of Indiana, he advocates the using of the undeveloped deposits of shale and fire-clay which are found in vast quantities and which have been tested and found suitable for making the best paving brick. He favors the purchase of an extensive bed of shale in western Indiana and the erection of a modern brick plant. He would equip the plant with convict labor and put several hundred additional convicts to breaking stone for foundations and cutting it for curbing. This brick and stone could then be furnished at the plant at less than one-sixth of the present prices to the counties devoid of other road material, or, if they are unwilling to buy it, the material could be given to them.

Mr. Blatchley does not give the estimates on which he bases these low figures of cost, but, though the cost may be underestimated, the employment of the convicts will be worth what the excess of expenditure over income may be, even though the road materials are donated to the counties.

Greater Asbury Park.

The residents of the various New Jersey municipalities affected by the proposed plan of consolidation with the Greater Asbury Park will probably vote on the matter March 8. A bill will be introduced by Senator Brown early in March. As submitted, the boundary lines begin at Wesley Lake; thence westerly through

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the center of the street to Main street. The lines follow Main street south to the northerly boundary line of Bradley Beach; thence easterly to the ocean, thus excluding Ocean Grove. South they go to the Shark River; thence westerly through the north branch of the Musquash Creek to Reynolds bridge; then back again north along Corliss avenue to Springdale avenue on to West Asbury, to the westerly line of Ivy place in West Allenhurst; thence easterly again along Deal Lake to the southerly boundary line of Allenhurst to the ocean.

Electric Power for New York Central Railroad.

Plans for the entire reconstruction of the New York Central roadbed for a distance of thirty-five miles from the city of New York northward and the elimination of all grade-crossings on the Hudson River and the Harlem divisions have been made and have been submitted to the local authorities of Yonkers, Mount Vernon, Irvington, Tarrytown and Ossining. The work of reconstruction will begin as soon as the necessary consents and agreements of the municipal villages and county officers are obtained. The work will include the laying of an electrical third rail system over and under all the streets, grounds and highways now crossed at grade. Electrical engines, supplied from the power-houses at Yonkers and Fort Morris, will take the place of steam power.

Conference of Legislators with Iowa Municipal League.

Members of the Iowa League of Municipalities met with joint legislative committees recntly and asked for an appropriation of $5,000 for furthering the work of the league. It also recommended several different matters of legislation relative to the government of municipalities, particularly along the line of municipal ownership, to which the members, as a whole, are favorable. The appropriation of $5,000 would be used for the collection of statistics relative to water works, gas, salary paid all others. An additional allowance is to be given under the provisions of the proposed bill for service on the board of review. Legislation providing for a uniform accounting system in cities and for the annual examination of the accounts of cities and towns by the State Auditor, is also proposed.

Small Parks for Chicago.

In discussing the accepted plans of Olmstead Bros. of Boston for the small parks to be established on the South Side in Chicago, Ill., President Foreman of the South Park system recently said:

The new parks will be the best preventive of crime that possibly could be found. Environment is everything in the development of a child, and the children who grow up in the sight of green grass and trees and flowers, and with opportunities to expend their energies in healthy sports and amusements, will not become vicious men and women. The lack of refining influences sends young men into paths of crime. To provide such influences is to provide the foundation of good morals and good morals make good citizenship.

In developing the plans for this system of small parks we have also had the idea of applying the social settlement idea to public institutions. What the social settlement, through the devotion of noble individuals, has accomplished for the people of certain neighborhoods we purpose bringing about through public funds and public agencies. Places where mothers and children can find rest and inspiration for the duties of life, gymnasiums where bodies can be developed into strength and symmetry, and public meeting places where the social instinct shall be developed—these are the things we mean to build.

The fourteen parks that we are about to construct will have swimming pools, gymnastic apparatus of all kinds, ball grounds, boating facilities, sand piles and many other opportunities for exercising young muscles and young activities. One of the chief features will be public meeting halls, where people can get together to hear lectures and hold discussions. This feature alone will be a great help toward bettering the conditions of our congested districts. I am anxious also to have music in the small parks, and provision is being made for this great educational factor of human development in the plans.

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to open some of them on the second anniversary.

The small parks have been selected on scientific principles. We made population maps, showing the congested districts, and located the parks where they were most needed along the lines of future development of residence districts. Further, we have placed them so that they can eventually be adjacent to an extension of the boulevard system. They will thus be of immediate and future benefit. The largest of the parks, between Sixty-seventh, Seventy-first-sts. and California and Central Park-ave., will be as large as Washington Park, and nearer to the center of population of the town of Lake than was Washington Park ten years ago.

Grant Park will be a beautiful setting for a beautiful gem, the Field Columbian Museum. Though the building will be the most conspicious feature of it, there will be delightful lawns, trees and views out over the lake, and a superb drive. It will be one of the greatest panoramas in the world. In two years we expect to have the filling for this park completed. There is money enough on hand for all our work, and we shall not build beyond our means. It will be a question of only a little time before this park is connected with Jackson Park with a boulevard along the lake.

Illinois University College of Engineering.

The President of the University of Illinois and the board of trustees have reached a decision concerning the disposition of the appropriation of $150,000 made by the state of Illinois for the equipment of the College of Engineering. The sum of $30,000 is to be reserved to extend the present equipment for the use of the undergraduate classes. The remainder, after full consideration of the best means of providing opportunities for advanced research and for furthering the interests of the engineering professions and other public affairs, largely managed by engineers and particularly to materially elevate engineering education, will be used to establish an engineering experiment station, which will be the first ever instituted in connection with any state university in this country Two buildings of simple construction will be built as follows:

1. A foundry, costing $10,000, to permit the present forge and machine shops to be enlarged enough to receive the students now in attendance.

2. A steam engineering laboratory, costing $20,000, to contain machines and apparatus for advanced experiments on steam engines and boilers, gas engines, gasoline motors, compressed air, etc.

U. S. Civil Service Examinations.

An important examination will be held April 1, 1904, by the United States Civil Service Commission to secure constructing engineers on the reclamation service of the United States Geological Survey at salaries of $3,600 to $4,800 a year. The subjects for examination will be the applicant's education and training, counting 10 points; his professional experience in general engineering, counting 20 points; his professional experience in construction, counting 50 points, and a technical description in detail of the most important piece of engineering work done under the applicant's supervision, counting 20 points. Personal attendance is not necessary, the papers being sent to Washington. The commissioners expect to have the assistance of a board of eminent engineers in rating the papers.

This form of examination for this class of work is eminently proper and apparently complies with the requirements of the law.

An examination for engineer draftsmen in the supervising architect's office at $1,400 and $1,600 a year will be held at the usual places on April 6, 7 and 8, 1904.

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MUNICIPAL AND TECHNICAL LITERATURE

Chicago Damage Suits—Duluth and Nashville Public Work—New Publications—Municipal Reports.

Millions in Damage Suits Against Chicago.

A report was made public Jan. 31 by John W. Smulski, city attorney of Chicago, in which he states that suits for personal injuries, amounting to $38,666,352, are pending against that city. The majority of the suits result from injuries received from sidewalks. An appeal for relief is made to the council, the legislature and finally to the people. Mr. Smulski says in his report that the interests combining to loot the city in this way amount practically to an organization. The names of lawyers, mostly young men, and doctors, occur with great frequency in the lists of suits. He says the piling up of suits will inevitably continue for some years, even should the city at once begin to tear up every wood sidewalk. He says the main cause of this condition is the deplorable state of the city's finances, which makes it impossible to care properly for its streets and sidewalks. The remedy lies in a new city charter, and he points out the many judgments awarded against the city and says that unless favorable action is taken in regard to a new city charter inevitable bankruptcy will result.

Public Work in Duluth, Minn.

The annual report of City Engineer Patton of Duluth, Minn., which has been filed with the City Clerk, states that the street improvements recommended for last year amounted to $2,187,626.12, but it was impossible to accomplish more than 30 per cent. of the work. Mr. Patton recommends the establishment of street monuments in West Duluth, urging that be restored and states that the department was unable to do this work last year owing to the lack of funds. Last year a sum of $13,333.30 was appropriated for the engineering department out of the public fund. The value of contract work begun by the city and the estimated value of improvements made by private parties under direction of the department for the year was $226,581.31, divided as follows:

Buildings	$ 11,295.35
Street improvements, paving	135,747.03
Sidewalks	46,532.22
Bridges	11,367.02
Sewers	21,639.69

Mr. Patton says that it is the custom to retain a certain per cent. of the estimate from the contractor to guarantee that the work will be kept in order for five years. During the year 17 miles of sidewalks were built, consisting of 13.93 miles of wooden and 3.6 miles of cement and tile walks.

Public Work in Nashville, Tenn.

The annual report for the year 1903 has been submitted to the board of public works at Nashville, Tenn., by W. W. Southgate, city engineer. During the year the city has expended for special street work, $119,370.08, of which $73,393.92 was contributed by the city, $45,976.16 by the street railway company, and $6,000 by property owners for paving Broad-st. and West End-ave. Street work other than special street work during the year cost $56,397.25, and during the year the total expenditures for special and other street work amounted to $175,767.33. Bitulithic paving was laid on Broad and Woodland-sts. and West End-ave.,

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by 337 acres; the length of the streets by 9 35-100 miles; the length of the alleys 3 miles, which was occasioned by the annexation of the new territory in proximity to Centennial Park, known as the Twenty-fifth ward. The total length of streets graded and macadamized during the year was 2 8-10 miles. The total length of both trunk and lateral sewers constructed during the year under the supervision of the engineering department was 8 miles. This makes the total length of all sewers in the city, up to January 1, 1904, 67.2 miles. Mr. Southgate says:

If the present policy of the board in extending the lateral sewers, in so far as funds are available, and as rapidly as trunk sewers are afforded, and in such manner as to carry out a comprehensive system, accommodating entire neighborhoods at one time is pursued, it will not be a great while until the city will be accommodated with a sewer system the equal of any in the country.

The city is frequently put to an unnecessary expense to clear lateral sewers that have become clogged by reason of water closets emptying into the sewer, either without any, or without adequate water fixtures for properly flushing the closets, the result being that the soil lodges in the sewer. I would suggest that the board request the Mayor and City Council to so amend the ordinances governing sewer connections as to forbid that any water closets remain connected to a sewer without adequate water connection to properly flush the closets and sewer out, and fixing a proper penalty for the violation of such a requirement. It would also be well to request the Mayor and City Council to require by ordinance that all closets or privies within a certain specified distance—say 250 feet—of an available city sewer, shall be directly connected therewith by a proper water closet arrangement.

New Publications.

The Testing of Road Materials, including the methods used and the results obtained in the Road Material Laboratory incollaboration with the Office of Public Road Inquiries. By Logan Walter Page, Chief and Allerton S. Cushman, Chemist Road-Material Laboratory, U. S. Department of Agriculture, Washington, D. C.

The road material laboratory is now nearly three years old and its methods of work have begun to take form, and their present state is shown in this pamphlet. Wooden blocks, brick, stone and gravel are tested for hardness, absorption, abrasion, toughness, cross breaking and tensile strength, specific gravity and weight, and cement is tested both chemically and physically. Methods and machinery for all these tests are set forth and many results are given. Forms for making reports and forms for recording street traffic are given. The publication should be valuable in inducing uniformity in testing methods and in making known the facilities for and conditions of public testing in this laboratory.

Critical Review of the Second Series of Analysis of Materials for the Portland Cement Industry, Made Under the Auspices of the New York Section of the Society of Chemical Industry. By W. F. Hillebrand.

This paper is a reprint from the Journal of the American Chemical Society, and is of much interest at this time on account of the active work which is in progress toward uniformity in methods of analysis and test of cements. It is too technical for abstract, but can doubtless be obtained in full on application to Mr. Hillebrand or to the society.

L'Etude des Eaux de Sources. La Fievre Typhoid a Auxerre en 1902. Sources de in Dhuis. Choix de l'Emplacement des Cimitieres. Les Cavernes Penetrables a l'Homme. By Max le Couppey de la Forest, Secretary of the Commission for Study of the Water Supplies of Paris, France.

The first four of these pamphlets are reports of sanitary investigations made by M. de la Forest in the line of his duties. The first and third are studies of spring water and of river sources and the second of a typhoid fever epidemic. The last describes some caves of greater or less extent. M. de la Forest has recently completed a tour of the United States for the purpose of obtaining additional information regarding all these lines and the report of his visit is awaited with much interest.

Water Supply and Irrigation Papers, U. S. Geological Survey, Washington, D. C.

The papers in this series issued since March, 1903, are as follows:

No. 77, on the water resources of Molokai, Hawaiian Islands, by Waldemar Lindgren.

No. 78, a preliminary report on artesian basins in southwestern Idaho and southwestern Oregon, by I. C. Russel.

No. 79, on normal and polluted water in

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northeastern United States, by M. O. Leighton.

No. 80, on the relation of rainfall to run-off, by G. W. Rafter.

No. 81, on California hydrography, by J. B. Lippincott.

Nos. 82, 83, and 84, report of progress of stream measurements for 1902, by F. H. Newell.

These titles serve to show to some extent the breadth of the work of the survey and the examination of the pamphlets makes known this practical character, though the preliminary nature of some of them is mainly indicative of what may be expected of the later full reports. Those interested in the subjects treated can obtain copies of the various papers on application to their Congressmen or in some cases to the Director of the U. S. Geological Survey.

L'Etat Actuel de l'Electroculture. By M. E. Guarini, 70 Bvd Charlemagne, Bruxelles, Belgium.

This little pamphlet gives the results of some experiments with the culture of vegetables under electric currents, showing the beneficial effects of certain currents and the methods of applying them.

Index of the Technical Press. Association de la Presse Technique, Bruxelles, Belgium.

The monthly numbers of this valuable publication show constant improvement, and though scarcely a year old are now quite four times the size of those at the beginning. The editors cover the periodicals which they index more thoroughly than any similar publication and give full representation to all branches of engineering. A large number of American and foreign periodicals is now on the list and the price of subscription, 5 shillings ($1.25) a year is no indication of its value. Only a large circulation can make so low a price possible.

Merchants' Association Review, vol. vii, to September, 1903. Merchants' Association, San Francisco, Cal.

The collection of the monthly numbers of the publication of the San Francisco Merchants' Association shows clearly the value of the work done by this public-spirited body, to which the city of San Francisco is most largely indebted for and a field for the discussion of public problems and the formation of public opinion. The public-spirited business men of other cities may well study the methods of this active club and can attain to some measure of its success if they will put into their efforts the same business ability and push.

Nine Feet from Pittsburg to Cairo. By Albert Bettinger, Cincinati, O., 16 pp. and map.

This pamphlet contains a speech by the Hon. Albert Bettinger of Cincinnati before the ninth annual convention of the Ohio Valley Improvement Association at Evansvile, Ind., in October, 1903, and gives the arguments in favor of a nine-foot stage of water from Pittsburg to Cairo. It is full of facts and figures and should have a favorable effect upon public opinion in this direction.

Proceedings of the Twenty-third Annual Convention of the American Water Works Association, Held at Detroit, Mich., June, 1903. John M. Diven, Secretary, Elmira, N. Y.

This volume contains 724 pages without counting the advertising pages, is printed in large and readable type and is well illustrated with a photograph of President L. N. Case and numerous drawings and photographs illustrating the various papers which were presented.

Many of the papers are of much value and the discussions as well as the other proceedings of the convention are given in full.

An arrangement has been made by which the proceedings can be obtained of the secretary, the amount paid for them being credited on his membership fee if the purchaser makes application for membership during the year.

The association is in a flourishing condition and about 350 members and their families attended the convention. The next meeting will be held in St. Louis.

Free-hand Lettering: Being a treatise on plain lettering from the practical standpoint for use in engineering schools and colleges. By Victor T. Wilson, M. E. 105 pp., 13 plates. Cloth, $1. John Wiley & Sons, New York City.

Mr. Wilson has prepared a very satisfactory little book for the beginner on simple lettering. He rightly assumes

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If combined with Brown's "Letters and Lettering," which was reviewed in Municipal Engineering some months ago, the two books cover the whole field of lettering very satisfactorily.

Hendricks' Commercial Register of the United States, for buyers and sellers. Especially devoted to the interests of the architectural, mechanical, engineering, contracting, electrical, railroad, iron, steel, mining, mill, quarrying and kindred industries. 1,326 pp. Cloth, $6. Samuel C. Hendricks Company, 76 Elm st., New York City.

This is the edition for the year beginning Nov. 1, 1903, of the standard directory of manufacturers, dealers, engineers, architects and all other interested in any sort of construction or in materials and apparatus for construction. The book increases in size each year, an indication that it is keeping up with the developments in business. A measure of this increase is found in the index which, in the last edition ocupied 138 columns, and in this edition requires 168 columns. A little circular of question and answers, which can be had for the asking, shows what the scope of the book is and some of the many uses to which it can be put.

The Mechanical Engineer's Reference Book, by Henry H. Suplee, Member of the American Society of Mechanical Engineers.

This book is published by J. B. Lippincott Company, Philadelphia, Pa. The demand for the book has been so large that a second printing was required before the date of publication of the book, and the publishers are now prepared to fill all orders. The work contains 800 pages, 450 illustrations, and is furnished with a very complete index. It is of pocket size, bound in limp leather, and can also be supplied with a thumb subject-index for 50 cents additional to the regular price, which is $5 net. Fuller notice will be given later.

Municipal and State Reports.

Eighth Annual Report of the Board of Water Commissioners of Atlantic City, N. J., for year ending September 1, 1903. Kenneth Allen, Engineer and Superintendent.

Under Mr. Allen the works, which were recently acquired by the city, have been considerably improved and recommendations for further improvements are made in the report. The summary of statistics is made on the standard form.

The cost of the works has been $1,302,402 and the bonded indebtedness is $1,250,500. The sinking fund now amounts to $31,500. Receipts from water rates have been $52,211 and from bond issue $85,000. Maintenance cost $59,176, interest $57,643 and the sinking fund took $36,211. Construction cost $46,993.

The estimated city population on the lines of pipe is 35,500, but the summer population is more than this by 100,000 to 225,000 persons, ordinarily 150,000. This causes some peculiarities in the consumption. Thus the average daily consumption for the year is 3,967,546 gallons and the average during the summer on the basis of 150,000 additional population is 5,656,335 gallons. The average consumption per inhabitant computed in the usual way is 110 gallons. The summer consumption is 38 gallons and the winter consumption is 94 gallons, computed on the average population for the two seasons.

Monthly analyses of the water are made, both chemical and bacteriological. The water in the Absecon Canal, the source of supply, comes from cedar swamps and there is salt from the sea spray blown inland in storms, which make the ordinary chemical indications of little value. Bacteriologically the water shows well, there being seldom more than 300 bacteria per cubic centimeter, and bacillus coli communis seldom showing a sample of one cubic centimeter, though they always show in quantities of 10 and 20 centimeters. The removal of barns and barnyards on the banks of the reservoir and canal is recommended to insure safety from accidental pollution of a dangerous character.

Fifty-first annual report of the Railroad Commissioners of Connecticut, with statistical tables of steam and street railways. W. F. Willcox, W. O. Seymour and O. R. Fyler, Commissioners, Hartford, Conn.

The railroad statistics are of great value and interest, but room can only be made for a few. The length of road reporting is 4,438 miles, 1,861 miles being in Connecticut. The average cost of the roads was $78,056 a mile, the average capitalization is $78,062 and the average funded debt is $24,557. Gross earnings are $20,748 per mile of road operated, net earnings $5,302 and operating expenses $16,295. The summaries in the report go into detail on maintenance of way and equipment, transportation, traffic and freight, fuel, employes, equipment, accidents, grade crossings, etc. The net earnings are 7.6 per cent. of the total capital stock and indebtedness. Still greater detail is given regarding each individual road, the same for both steam and electric lines.

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The street railways show an average cost of construction and equipment of $80,773 a mile of road owned and $66,939 a mile of road operated. Capital stock per mile of road owned is $45,122, and bonds are $34,931 per mile, including sidings. The gross earnings are $6,798, the net earnings $2.021 and the operating expenses $4,777 per mile operated.

An appendix gives the state laws regulating railroads of all kinds and the powers and duties of the Railroad Commission.

Third Report on the Highways of Maryland, by A. N. Johnson, Highway Engineer. Maryland Geological Survey, Johns Hopkins University, Baltimore, Md.

Aside from the reports of the small amount of road improvement done under the present laws, the report contains some valuable work, such as an outline of a county road law prepared at the request of the grand jury in one county. This provides for a board of road commissioners, a roads engineer, supervisors of districts, methods of making appropriations and keeping accounts.

Some tests of paving bricks, comparing the use of old cast-iron shot, new cast-iron shot and chilled steel shot are given, showing percentages of loss in the rattler of 16.2, 17.9 and 20.7 with the three kinds respectively, with a hard brick, and 24.2, 24.5 and 28.3 with a soft brick. The shape of the shot is said to exercise little influence, and the hardness of the brick, in comparison with the difference in equality of material of which the shot is made.

Some tests of concrete bars 6 by 6 by 24 to 30 inches are reported, also some tests on the tensile strength of cement. The latter were made on rings which were pulled apart by exerting air pressure on the inner surface of the rings. The data are not sufficient in number to warrant conclusions as to the comparison of this method with the ordinary briquette method.

Mayor's Annual Message and the twenty-seventh annual report of the Depart-

shows the reasons for the poverty of the city in low valuations and favoritism of officials fixing the valuations and tax rates. The street question is well handled. A compliment is paid to creosoted wood blocks and a municipal creosoting plant at the house of correction is suggested. City work is said to compare favorably with contract work, and contractors' combinations are blamed for high prices, so that it is claimed the only solution of the present difficulties is a municipal department of construction. The work done in removing garbage is commended in this connection. The city has completed by day labor contracts on a land tunnel of the water works and one of the tunnels under the lake which had been abandoned by the contractors and has also constructed by day labor two water pipe tunnels and is now building a lateral intercepting sewer. In all these cases the Mayor gives comparisons showing the superior results of the municipal construction, and especially the saving in cost. The civil service is commended. Track elevation, subways, pneumatic tubes, strikes and social problems have their full measure of attention.

Fifth Annual Report of the Board of Water and Light Commissioners, Duluth, Minn., 1903. L. N. Case, Manager and Secretary.

The earnings of the department for 1903 exceeded the expenditures for operation, maintenance and interest charges by $32,000. The accumulated earnings of the department are $90,000, nearly all of which has been applied on construction. The demands for extensions are greater than can be met in this way and $50,000 additional is desired, which would be added to the bonded indebtedness. Extensions are only made when the guaranteed income from them will pay 8 per cent. on the cost, but the cost is computed at $1.50 a foot, that of pipe for local service, and when the necessities of the distribution service require larger pipe, the board considers the additional cost properly a charge upon the system at large. Rock excavations sometimes make a similar

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consumers $2,648, or a total profit of more than $10,000.

A new pump is one of the necessities of the immediate future.

The board also operates the city gas works, which earned $4,584 of the surplus given.

A contract has been made with the Zenith Furnace Company to furnish gas to the city for its distribution, at a price slightly less than the cost of making gas in the city's own plant. The surplus is $3,000 greater than for the year before, although the higher price of coal added $3,572 to expenses and the reduction in rates from $1.15 to $1 made a reduction in receipts of $5,272.

A court decision has established the power of the board to install water meters wherever it suspects waste of water.

An interesting table gives the cost of making gas and the amount of gas lost and unaccounted for. The monthly averages of cost of gas actually made range from 37¼ to 50 cents per 1,000 cubic feet, and the gas not acounted for varies from 3½ to 18 2-3 per cent. of the amount made.

ORGANIZATIONS AND INDIVIDUALS

Michigan Municipal Societies—Electric Club—Technical Club—Personal Notes.

Convention of Michigan Municipal Societies.

The Michigan Political Science Association and the League of Michigan Municipalities held a joint convention in Ann Arbor, Mich., Feb. 11 and 12, at which there was earnest and careful discussion of some important municipal problems.

Municipal ownership of public utilities was discussed pro and con by F. F. Ingram and C. A. Kent of Detroit.

Prof. Kent is the president of the Political Science Association. He took a decided stand against the public ownership, on the ground that the interest of the workers is destroyed if they are employes of a government.

Private enterprise safeguards itself at every step along lines of economy and efficiency, but in governmental affairs these precautions are sensibly relaxed. Even if the public officials are honest and well meaning, private affairs and the necessity of maintaining their political standing interfere very greatly with their administration of their public duties.

Another argument is that public ownership tends to an increase of taxation, by removing taxable enterprises from the field.

Thirdly, public ownership tends to make the government all powerful, which is contrary to our 9nglo-Saxon principles.

The advocates of public ownership of public utilities, are obliged to go to Great Britain for example of their theory, and then the question is still subject to debate. In Glasgow the most striking example, the taxes have increased greatly during the past decade.

Municipalities are popularly supposed to treat their working men better than do private enterprises, and their argument naturally appeals to the poor.

One who would radically change the great machinery of society had better look carefully to what he does. At what stage in the process of acquiring wealth does a nobleman worry his fellows? He works himself up from the bottom by organizing and developing enterprises that give employment to workmen. The poverty of the multitude is a great evil, but in this country at least its main cause is the willingness to live on a bare subsistence. For the mass of the poor the only real help is the instilling of new wants and the creating in them of the industry necessary to gratify these wants. Business seems doomed to vibrate between too great competition and too great combination. The extreme of socialism is unthinkable, but the scope of government may be greatly increased.

There is a limit to the amount of taxation, as people cannot pay taxes unless their income is enough larger to allow them to live on the difference. Contests

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as to wages are really contests between different classes of workers, as the consumer pays for any increase in the cost of production. Combinations of capital under government would have the same evils as the trusts.

Mr. Elmer Swarthout of the Grand Rapids city council, read an interesting paper on "Some Requisites of a Good City Charter." The first part of this was a discussion of the place which should be given to the council in the scheme of municipal organization. After considering the plans for centralizing all power in the hands of the mayor and for establishing bicameral councils, Mr. Swarthout disapproved of both. He believed in a single council with large power. This would be more economical than the bicameral system, would fix responsibility and would avoid the confusion which exists where the ordinance power is distributed among various boards and officials. This would be following the same plan as private corporations, where the board of directors is the general policy determining power. At the same time the council should not have executive or administrative powers; but these should be centered in the control of the mayor.

The latter part of the paper discussed charter provisions in reference to franchises and street improvements. On both subjects the provisions of the Grand Rapids charter were critised, and those of the recent charter of Portland, Ore., were cited aprovingly. In reference to franchises, these limit the terms of franchises to twenty-five years, require public notice and a two-thirds vote of the council to grant a franchise, provide for public reports from the franchise company, authorize a referendum on all franchises on the petition of 15 per cent. of the voters, and empower the city to own and operate public utilities. Mr. Swarthout did not favor municipal ownership of street railways, but legal authority to do so, as a means of controlling the franchise corporations.

He did approve, however, of cities owning and leasing the street railway roadbeds.

Papers were read on "Public Works in Detroit," by Commissioner W. H. Maybury and on "The Separate System of Sewers for Small Cities," by Mayor E. jection. It is free from any of the more important objections that are urged against its application to larger and differently constituted communities. It is sound in theory and has proved effective in practice. Still better results may be expected as the weaknesses of the law appear through repeated application and are remedied. For my own part I am confident that it will do more to reform our municipal governments than any other change suggested or projected. The reform in the nominating system is a fundamental reform, for nearly all public ills may be traced to the initial step in the choice of public servants.

The Ohio Municipal Code was explained by M. G. Denman, city solicitor of Toledo. The progress toward uniformity in municipal accounting was recounted by Charles Carroll Brown of Indianapolis, editor of Municipal Engineering, special attention being given to the new Ohio law. The work of the Wisconsin league was described by Prof. S. E. Sparling, its secretary.

The social features were not neglected. Such meetings as this are fruitful of results beneficial to the government of the municipalities of the state and country. Prof. J. A. Fairlie, the secretary of both organizations, was largely responsible for the high character of the papers presented and for the general success of the convention.

Technical Meetings.

The fourth annual meeting of the Wisconsin Clay Workers' Association will be held at Portage, Wis., March 1, 2 and 3.

The twenty-sixth annual convention of the Illinois Clay Workers' Association was held at Danville, Ill., January 5 and 6. Among the papers presented were the following: "Civic Improvements," D. H. Jansen, Pekin, Ill.; "Necessary Sizes of Drain Tiles," L. R. Whitney, Terre Haute, Ind.; "Road Construction," F. S. Selley, Danville, Ill.; "Power Generation for Brick Plants," John T. Thompson, Chicago. Officers for the ensuing year were elected as follow: president, Frank W. Butterworth, Danville, Ill.; vice-president, O. W. Dunlap, Bloomington, Ill.; secretary, George H. Hartwell, Chicago;

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boards of supervisors of the state of New York was held at Albany, N. Y., January 26 and 27. Officers were elected as follows: chairman, Hon. Eugene L. Burnette, Ontario county; secretary, H. E. Cook, Lewis county; vice-presidents—Peter Walker, Albany county; Una A. Pollard, Broome; F. E. Whitmore, Cortland; Geo. H. Butterfield, Chenango; James A. Woodward, Erie; E. V. Decker. Herkimer; A. Bickelhaupt, Jefferson; Adam Kotary, Lewis; J. Y. McClintock, Monroe; T. R. Staley, Montgomery; F. E. Swancott, Oneida; John Schumann, Jr., Rensselaer; Joseph S. Barnes, Seneca; Phillip Shautz, Ulster; Dr. Wm. C. Smith, St. Lawrence.

The next annual convention of the National Good Roads Association will be held in St. Louis, May 19, 20 and 21. Practical demonstrations of road making methods will be given during the convention.

The twelfth annual convention of the Northwestern Electrical Association was held in Milwaukee, January 20, 21 and 22. Officers for the ensuing year were elected as follows: president, T. F. Grover, Fond du Lac, Wis.; vice-presidents, George H. Lukes, Evanston and F. A. Daniel, Menominee; secretary-treasurer, Thomas R. Mercein, Milwaukee.

The eighteenth annual convention of the National Brick Manufacturers' Association was held at Cincinnati, O., Feb. 1 to 13 inclusive. Among the papers presented were: "Neglected D etails in Brick Pavement Construction," Prof. I. O. Baker, Champaign, Ill. and "Brick Pavements, or the Permanent Improvement of City Streets," W. E. Gunn, C. E., Covington, Ky.

The nineteenth annual meeting of the Illinois Society of Civil Engineers and Surveyors was held at Champaign, Ill., Jan. 20, 21 and 22. Prof. Ira O. Baker opened the meeting with an address of welcome to which President John W. Alvord responded. An address was then delivered by Dean N. C. Ricker on the College of Engineering of the University of Illinois. The annual address of President Alvord, on "Harnessing the Forces of Nature for the Use of Man," followed. In the absence of F. E. Herdman, his paper on "Municipally Owned Water, Gas and Electric Light Plants," was read by the secretary, and the methods employed by Winnetka to furnish its residents with light and water were described. The practical uses of concrete on the farm were described by L. Z. Jones. O. L. Gearheart submitted a paper on "Concrete Foundations for Pavements."

The sixteenth annual meeting of the Iowa Engineering Society was held in Des Moines, January 20, 21 and 22. A paper on "Nishnabotna River Improvements" was read by Seth Dean of Greenwood; "Street Grades" by Prof. L. Higgins of Des Moines; "Experiences of a County Surveyor," I. W. Hoffman of Carroll; "The New Melan Arch Bridge at Waterloo," W. L. Newton; "Sanitary Engineering," Prof. C. S. Magowan of Iowa City; "Official Methods in Structural Iron Works," Prof. L. E. Ashbaugh of Ames; "Railway Construction from the Resident Engineer's Standpoint," Prof F. C. French of Ames; "Electric Power for Railways," Prof. B. S. Lamphear of Ames.

The Engineers' Club of Columbus, O., elected officers February 6 as follows; President, W. F. McGruder; vice-presidents, W. T. Guy and W. K. Danman; secretary, H. M. Gates; treasurer, Wm. Michael.

The Engineers' Club of Philadelphia, held a meeting February 20 and a paper on "Reinforced Concrete in Building Construction." was read by E. G. Perrott.

Personal Notes.

John E. Reynolds has been elected Mayor at Meadville, Pa.

J. W. Barnett has been reappointed city engineer at Athens, Ga.

T. J. Moreland has been re-elected city engineer at Knoxville, Tenn.

J. P. Ogden has resigned as first assistant city engineer at Cleveland, O.

Edward Lynch has been reappointed fire commissioner at Fall River, Mass.

Hon. John A. Roche, former mayor of Chicago, Ill., died suddenly February 10.

William Gavin Taylor has been reappointed city engineer at Medford, Mass.

Robert Hoffman has been appointed first assistant city engineer at Cleveland, O.

Robert Clark, jr., has resigned as a member of the council at North Plainfield, N. J.

Daniel Phillips has been appointed councilman, to succeed C. U. Davis, at Glenville, O.

Walter W. Crosby has accepted the general superintendency of parks at Baltimore, Md.

John F. Sprenkle has been elected superintendent of the Lehigh Water Company, at Easton, Pa.

Park Woodward has been re-elected general manager of the water-works department at Atlanta, Ga.

William Mayer, alderman and chairman of the finance committee of city council at Chicago, Ill., died February 12 of apoplexy.

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David Hoover has been re-elected superintendent of the Waynesboro Water Company at Waynesboro, Pa.

J. S. O'Connell has been appointed chairman of the Board of Water Commissioners at Marlboro, Mass.

George Dwyer has been appointed city engineer and Thomas J. Schoenlaub assistant city engineer at Marion, O.

Rufus Boyce has been reappointed a member of the water commission for a term of three years at Atlantic City, N. J.

Arthur J. Cox, secretary and treasurer of the Iowa Engineering Company, Clinton, Ia., will have his office at Iowa City, Ia.

Christopher Harrison has been reappointed city engineer at Everett, Mass. This is Mr. Harrison's seventh consecutive term.

David A. Hartwell has been re-elected city engineer at Fitchburg, Mass. Mr. Hartwell has held this position for thirteen years.

J. O. Magruder has been elected city engineer and Frank Talbott superintendent of water works and electric lighting at Danville, Vt.

Mr. Edward B. Ellicott, city electrician of Chicago, has been appointed chief electrician and mechanical engineer of the Louisiana Purchase Exposition.

George H. Boughman has been re-elected city engineer and James L. Zeigler and William E. Snyder first and second assistants, respectively, at Wilmington, Del.

Bertram Brewer has been reappointed city engineer, Richard A. Jones superintendent of streets and Leroy Brown superintendent of water-works at Waltham, Mass.

O. C. Simonds, landscape engineer, of Chicago, Ill., addressed the Woman's Club of Moline, Ill., February 15, on "Town Improvement or Beautiful Surroundings."

Asa B. Prichard has been appointed commissioner of streets at Somerville, Mass., to succeed his father John P. Prichard, who has held the position for nearly eight years.

John H. Kelman has resigned his position as superintendent of the Stanley Electric Company of Pittsfield, Mass., to accept a position with the Allis-Chalmers Company of Chicago, Ill.

George A. Clark of East Boston has been appointed engineer for Simpson Bros. Corporation, 166 Devonshire-st., Boston, to conduct the business of its steel-concrete construction department.

Russell L. Dunn has been appointed special assistant engineer for the Board of Public Works at San Francisco, Cal., in an investigation for fixing the water rates of the Spring Valley Water Company.

C. F. Berger, formerly with the Sandusky Portland Cement Company, is now the Chicago sales agent of the Atlas Portland Cement Company, with offices in the Marquette building.

John Geist has established an office as consulting engineer at 38 Exchange Building, Milwaukee, Wis. Mr. Geist has been acting as engineer of the Milwaukee plant of the American Bridge Company.

T. Chalkley Hatton, M. Am. Soc. C. E., has resigned as consulting engineer to the sewer department of Wilmington, Del., and will devote all his time to private practice.

Arthur W. Tidd has accepted a position as assistant engineer with the Charles River Basin Commission. Mr. Tidd has been recently engaged in work for the commission on additional water supply for New York City.

Frederick A. Waldron, formerly superintendent of power and plant at the works of the Yale & Towne Manufacturing Company, at Stamford, Conn., has established himself as a consulting engineer in power plant construction.

Mazyck Ravenel has been sent to Charleston, S. C., by the American Pipe Company to make an analysis of Goose Creek water, and as soon as completed the result of his investigation will be reported to that company.

Albert E. Greene, a practicing engineer and the son of the late dean of the engineering department of the University of Michigan, Charles E. Greene, has been appointed as assistant professor of civil engineering to take charge of the class work formerly done by his father. A successor to the deanship has not yet been appointed.

Dr. Kiosaburo Futami, professor of civil engineering in the Kyoto Imperial University, Japan, arrived in Boston, Mass., February 2. He will study certain branches of civil engineering, and particularly the bridges of the largest cities, while in this country. Dr. Futami is making his headquarters with the American Society of Civil Engineers in New York City while here.

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MACHINERY AND TRADE

St. Louis Bitulithic Contracts Upheld by Supreme Court.

The Missouri Supreme Court rendered a decision on Feb. 24 upholding the Board of Public Improvements of St. Louis in the matter of paving W. Pine-boulevard with bituminous macadam.

William F. Swift, one of the property-holders along the way of the proposed improvements, sought to invalidate the special tax bills because the city authorities specified Warren's bituminous macadam. The court holds that the Board of Public Improvements had authority, under the charter of the city, to so specify.

The decision sustained the judgment of Circuit Judge Wood, who, in giving his decision, said: "The testimony strongly tends to show that there are no manufacturers in the United States manufacturing coal tar cement for street paving purposes other than that manufactured by the Warren Bros." This statement the Board of Public Improvements quoted in their answer to the request by the House of Delegates for a statement in regard to why certain Warren's materials were specified in street bills in preference to other materials, which, it was claimed, barred competition on street work. Warren's waterproof cement, which is used in mixing the ingredients of bituminous macadam, is patented by the Warren Bros., and, according to the board members, is the best waterproof material ever submitted for paving purposes, and therefore had been recommended by them in construction work, where the board's discretion had been called upon.

Judge Gantt wrote the decision.

A report of the decision of the lower court, which is now affirmed by the Supreme Court, will be found in Municipal Engineering, vol. xxiv, p. 284.

Development of the Automobile.

The rapid and progressive growth of the automobile industry within the past ten years has had great influence on engineering problems. These vehicles are and have been one of the factors helpful to the movement for better roads and paved streets. The industry has opened a new industrial field for manufacturers and mechanical men. The problems that have been solved in connection with the automobile as a pleasure conveyance are now being adopted for every day, practical use. The plow, lawnmower, truck, reaper, fire-engine, street-sweeper, street-sprinkler, and many other horse-drawn vehicles have been the medium for application of power for self-propulsion.

The two great automobile shows of the year have been held at New York and Chicago, each of them giving a splendid idea of the advancement of the industry. Neither show exhibited anything radically new, although many builders and designers have changed their methods of construction. Foreign ideas are being taken by Americans and blended with our own methods, with the consequent increase in strength and utility.

The present tendency is toward the increase of power and the decreasing of weight in ratios that add strength, power and speed to machines. All manufacturers are endeavoring to bring the weights of their machines within the limits of one horse-power for every hundred pounds of weight or less.

The Chicago show emphasized the fact that the two-cylinder double opposed, and three and four-cylinder vertical motors are being universally recognized. The single cylinder engine has been discarded on all machines with the exception of runabouts, the main objection to it being its excessive vibration and the inability satisfactorily to construct single cylinder motors of over eight to nine-horse power, although the style is simple to operate and gives little trouble. The two-cylinder double opposed engine is especially well adapted to hilly country and bad, rocky roads, where large power is desired, but not great speed. This type gives very little vibration and propels a machine very smoothly. Many prominent firms exhibited cars with this style motor at Chicago. Among whom were such firms as the Winton Company, Haynes-Apperson Company, Stearns Bros., Kirk Manufacturing Company, Apperson Bros., and the Ford Company. It was a noticeable fact at Chicago that

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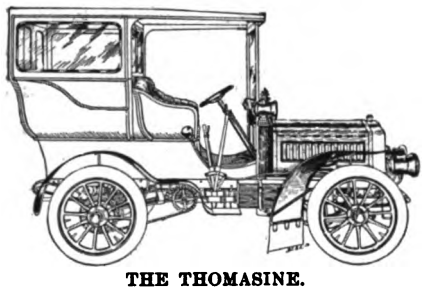
many new companies were following the lead of these older concerns and building cars with this same type of motor.

Quite a number of firms exhibited two-cylinder vertical engines. This is an economical engine and gives very good service, but it has been found exceedingly difficult to attain perfect balance for the reason that the cranks are necessarily opposed, while the cylinders and pistons are not, both being vertical. The positions of cranks and pistons consequently give the engine irregular impulses when an explosion occurs.

One of the newest and most thoroughly built cars and one that in all probability was surrounded more continually than others by mechanical engineers and enthusiasts was a three-cylinder machine. Although several American firms have been rather unsuccessful with this style of motor others have proved it is entirely practical and very serviceable. Prominent foreign manufacturers, such as the Panhard-



THE THOMASINE.
Instantly Convertible Into Inclosed or Open Car Without Alighting.

Levassor Company, are making a special feature of their three-cylinder motors. This engine gives almost perfect balance, with one-third less of wearing parts than a four-cylinder, is one-third less complicated and burns one-third less fuel, to say nothing of the decrease in trouble with valves, ignition, lubrication, bearings and coolings. Above all, and perhaps one of the most important features, it is less expensive than the four-cylinder motor, which gives the same results in regard to power and balance, but with the additional drawbacks mentioned. The three-cylinder motor was exhibited in such numbers at Paris that it was pronounced

cal construction and have at the same time provided for the safety and comfort of the tourist. Their three-cylinder motor develops twenty-four horse power at a normal speed of 900 revolutions per minute. The cylinders are cast individually, facilitating ease of repair in case of necessity. The power is transmitted through a very neat sliding gear transmission, with three speeds forward and one reverse, the drive being direct on the high gear, with no gears meshed. A countershaft, bevel geared to the transmission, then carries the power to the rear wheels through two side chains. Safety devices are numerous throughout the car, making it simple and safe for the most careless chauffeur. Three brakes are provided, one on the differential shaft and two on the rear wheels attached to drums. All brakes may be applied, the clutch disengaged and the throttle released by applying the emergency brake. Another feature that appeals to drivers in hilly country is the device that absolutely locks the rear wheels if through any mishap the car should begin to travel backward on a steep and treacherous incline. This is accomplished through the use of a pawl and ratchet in each brake drum on the rear wheels.

The Thomas people seem to have solved the problem of winter and summer touring with the introduction of their new six-passenger limousine body. This body is of beautiful design, resembling the usual canopy topped car, but the tonneau is very ingeniously inclosed in plate glass that may be taken out or put in with little trouble. A hot water pipe is run through the tonneau for the comfort of the occupants in cold weather. A plate glass is placed in front of the chauffeur and side curtains are provided for his protection.

With all of these features the car averages eighty-three pounds of weight for every horse power, thus making it one of the lightest of the high-power machines at the show.

Many cars were equipped with four-cylinder engines, ranging from sixteen to sixty horse-power. In fact, the general tendency seems to be toward four-cylinder motors. They give very little vibration with light power but are necessarily

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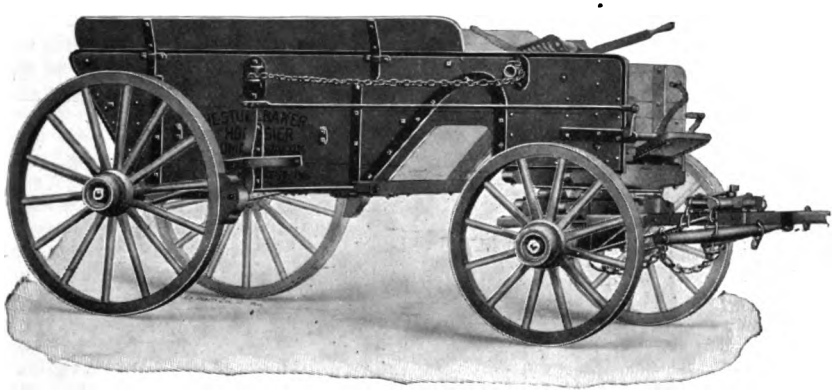
moving machine comes from the chains and transmission.

Foreign manufacturers are using the four-cylinder engine to a great extent and the American designs are following their lead. R. F.

A Successful Type of Dump Wagon.

The accompanying cut shows the Hoosier dump wagon, which is manufactured by the Studebaker Brothers' Manufacturing Company of South Bend, Ind. The cut shows most of the points of interest in the wagon, with its latest improvements, including the turn-under front gear and the levers and chains by which the driver can operate the dumping mechanism without leaving his seat. The Studebaker guaranty goes with this wagon, as it goes with all their vehicles. The company can furnish on the shortest notice any description of dump wagons, contractors' carts, garbage wagons, street sprinklers, street sweepers or other municipal vehicles of any sort. It has the reputation of keeping all its vehicles up-to date, equipping them with all the latest improvements.



THE STUDEBAKER DUMP WAGON.

Stone Making by the Lake Process.

Three patents have recently been issued to Mr. Albert Lake for molding artificial stone, which are the result of some years of experience in molding such stone and embody the ideas which he has developed as a result of this experience. One of these patents, No. 743,525, dated November 10, 1903, describes a method intended to produce a stone free from craze or surface cracks and having a smooth surface which can be used without tooling, or can be tooled in any manner desired. The special feature of the method is the filling of the mold partially with water before putting in the concrete mixture for making the stone. The mixture may be fed in dry or of desired consistency, and as it is deposited the water rises in the mold and when the stone is finished the water stands a fraction of an inch deep upon the surface. After about twenty-four hours the water has nearly disappeared, the mold can be removed and the stone is cured for any desired period before using.

The claims for the stone made in this way are that it is nearer the natural stone in appearance and color, that it is close grained enough to be waterproof, that it can be cut or ornamented like stone, has greater tensile strength than stone and is otherwise much stronger.

Blocks are made solid or hollow of any desired shape or reasonable size and with all sorts of ornamentation of face.

The wet process is used so that no tamping is necessary, and no acids are used. The process is simple and inexpensive and the product as stated above is claimed to be superior. Crushed stone and Portland cement are used and hollow blocks, plain or tooled face, are made for foundations and walls of plain buildings. Heavier and finer blocks with rock or tooled face are made for higher class building walls. Blocks of any size or shape, solid or hollow are made to suit any class of buildings for trimmings or for walls. The price of the common foundation blocks is low enough to permit competition with common brick. The walls of a building can be furnished complete from bottom of foundation to roof, or any part, including window and door

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sills and lintels, belt courses and cornices frieze, columns, capitals, pilasters, balustrades, posts, steps, caps, coping, chimney caps, as well as any oramental or useful objects usually made of stone of iron, terra cotta and other materials.

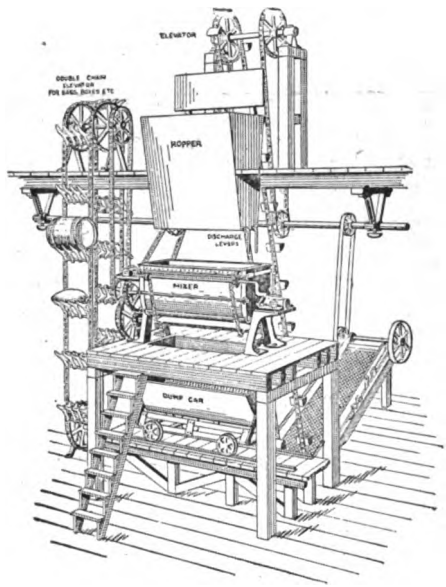
Montfort and Weaver, 45 Clinton-st., Newark, N. J., are the general sales agents for territory and appliances for operating under the Lake patents.

Artificial Stone Making.

In the rush to make a machine that would produce concrete building blocks, the most essential feature, that of producing a sound, correctly-formed block has often been overlooked. The Standard Sand and Machine Company, Cleveland, O., instead of rushing on the market last season put in the year in developing a block that is pronounced correct by en-

1 inch high and 4 inches wide on the under side of each block, thus connecting all vertical air spaces as well as forming a convenient hand-hold for the mason in laying the wall.

This form of hollow block is made in all sizes and shapes desired in building construction with one machine, a great saving in first cost to a concrete block manufacturer. The machine is built of iron and steel in a most thorough manner and has no complicated mechanism. It has few parts and a large range of adjustments. All width blocks are made with one size pallet, which feature alone is a great saving in the purchase price of a



CONCRETE BLOCK MACHINE
Of the Standard Sand and Machine Co., Cleveland, O.

machine. Newly-made blocks are delivered upon the side, thus seasoning them without a single crack or break in the withes (bonds). Face designs are made with a simple interchangeable panel device requiring but a few moments. They

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many plans of mixing plants installed by this firm.

A Prismatic Drum Concrete Mixer.

The Stanley Prismatic Drum Concrete Mixer is a new candidate ror popular favor, put on the market by the Contractors' Plant Company of 37 Pittsburg-st., Boston, Mass. This is a batch mixer adapted to steam, gasoline or electricity for motive power. It is driven from both sides with considerable savmg in power and in wear and tear, and is said to be the only concrete mixer so driven. The drum is an octagonal prism with the circular driving gears at the ends. Deflectors are attached to the plates of the machine in such way that the concrete mass is not only turned over by the revolution of the prism on its axis, but is thrown from side to side, thus giving the same effect as a cubical box swung from two opposite corners.

Barrows dump the material into one end of the machine. At the other end of the machine is a chute which in one position keeps the material in the drum, but by throwing a lever it drops into position to receive the material as it comes to its upper end and discharges it into a barrow or pile outside. The water is fed by automatic measurement. The drum continues its revolution without stop either for loading or discharging.

The capacity of this mixer is rated according to the product turned out. not according to the amount of materials put in. Thus a mixture of 5 cubic feet of cement, 12½ of sand and 26 of stone make 43½ cubic feet of materials, which is used as the measure of capacity of some machines. These materials make but 27 cubic feet of concrete or one cubic yard, and this is the rating of the Stanley mixer. The half-yard machine will hold materials enough to turn out 13½ cubic feet of concrete in one batch.

The machine is lighter than similar machines, but this lightness is not secured at the expense of strength. The drum runs so easily that, when empty, it can be revolved by one hand.

This company also manufactures a very satisfactory gravity concrete mixer.

The Stewart Cement Block Machine.

One of the simplest machines for making cement blocks is that put on the market by the Stewart Cement Block Machine Company of the Lafayette Building, Waterloo, Iowa.

The whole machine is operated with one lever. Throwing this lever down lowers the core, opens the sides and ends and raises the block out of the machine ready to be taken away. Throwing the lever back to place sets the machine ready to make another block. One movement is all that is necessary for each of these operations, for the machine is self-locking. The machine has no hopper, but is provided with an adjustable table level with the top of the box, which opens out of the way by the same motion which opens the mold or box. It is said that three men will make from 250 to 300 blocks a day with this machine.

Full-sized blocks of 8 by 24-inch face and 8, 10 and 12-inch widtn can be made, also fractional blocks 4, 8, 12 and 16 inches long.

The rapidity of action of the machine and the small number of men needed are said to make it possible to turn out blocks at lower cost than has heretofore been thought possible.

Machinery for Cement Blocks and Posts.

The Cement Machinery and Manufacturing Company of Burlington, Ia., is an organization formed to supply the rapidly growing demand for machinery for making various kinds of cement and concrete blocks, posts, etc.

The Chicago block machine of this company will make hollow or solid blocks and is adjustable for any sizes of blocks up to 48 inches long, 18 inches wide and 12 inches high. It will also make corner, pier, flue, circle and octagon blocks. Any desired design of face can be used.

Their Burlington rotary block machine will do the same work and it automatically releases the block from the mold, loads it on a car and runs the car, so that one man can operate the machine. The only handling necessary is to stack the cured blocks.

The Burlington rotary post machine has the same car system as the block machine. It makes fence posts, which can be reinforced with any number of wires, the clips being placed at any desired distance apart. One man can make from 100 to 150 posts a day 7 feet long and 4x4 and 2x4-inch dimensions at the two ends. The cuts on page 210 show the three machines mentioned.

The company also has a sidewalk block machine adjustable for any thickness of block up to six inches and any size from 16 inches to 36 inches square. This machine can also be used for pier and flue blocks.

With the Burlington brick machine

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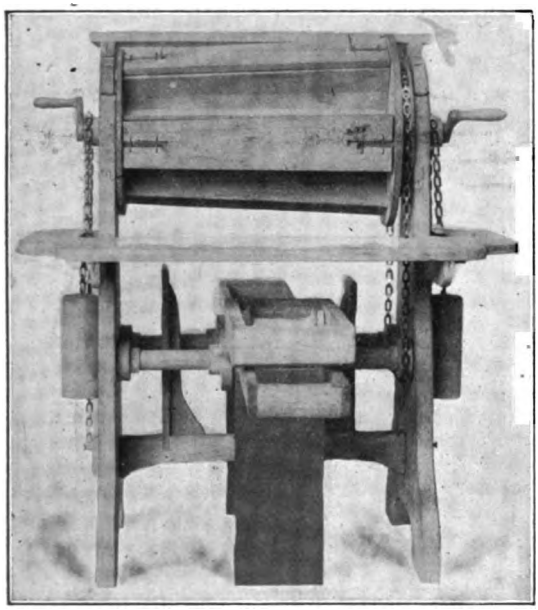
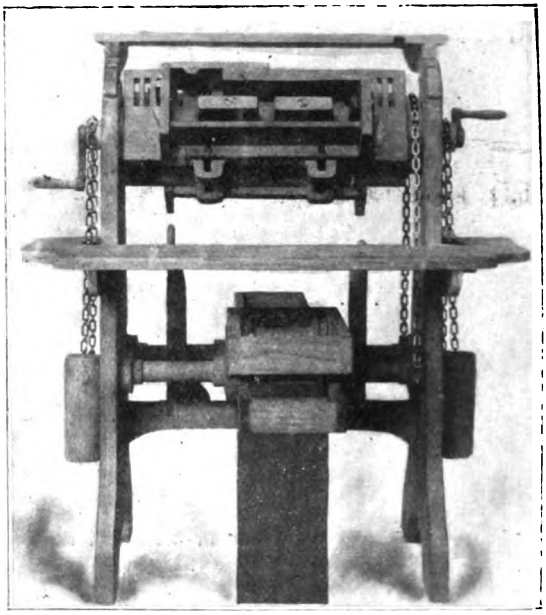
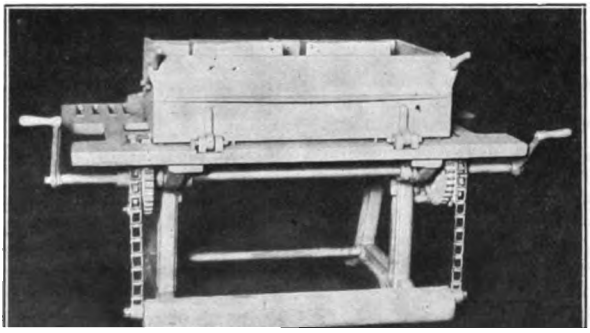


The Burlington Rotary Post Machine.



The Burlington Rotary Block Machine.



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from 15,000 to 20,000 bricks of standard size can be made in a day, it is said.

The Burlington sewer tile molds are of heavy sheet steel reinforced with band iron and have heavy cast caps and bases. They are made in stock sizes for pipe of 6 to 30 inches diameter, but can be made of any size desired. Tank molds designed on like principles can be furnished of any desired diameter.

The company also manufactures a solution which is said to make cement stone impervious to water. It can be applied by brush or sprayer.

The business of the company also includes the sale of engines, concrete mixers, Portland cement and other necessary machinery and materials.

LAW EXCHANGE, JACKSONVILLE, FLA.
Built of H. S. Palmer Hollow Blocks.

A Pioneer Cement Building Block.

The use of cement building blocks as a successful substitute for wood, brick, terra cotta and stone, as a real factor in the building world, is of most recent growth, though the crude idea is many years old. Durability is conceded, provided the blocks are made right by right people of right material by right machines and methods. It is clear that, when a manufacturer of cement block machines sells a machine he does not provide brains or common sense for the buyer. The maker of blocks must know something about cement, its qualities and methods of manipulation.

Harmon S. Palmer of Washington, D. C., may well be termed the pioneer in the field of cement block construction and use. His first cement block building was erected about sixteen years ago and is today one of the best evidences of the practicability of the method he has done so much to develop. There were many difficulties and great prejudices to overcome in manipulation and in the cheapening of the product, and the users of the machines in very many cases were ignorant of the methods to be used. Mr. Palmer's efforts have aided greatly in overcoming these difficulties and this ignorance, and with the cheapening in the cost due to the lower price of cement, the business of making cement blocks has advanced with amazing strides since interest was first strongly awakened in it, for which this magazine claims a fair share of credit, since the beginning of the rapid extension of the business coincided with the notice made in its pages of the new applicant for favor in concrete construction. The extensive sale of the machine shows its popularity, based on its adaptability to the conditions.

Mr. Palmer has just completed a large apartment building constructed of his blocks on Mount Pleasant Heights, N. W. Washington, D. C., on the lower floor of which are his offices and also his residence.

The accompanying illustration shows the Law Exchange, erected at Jacksonville, Fla., of the Palmer block. The title of Mr. Palmer's company is The Palmer Hollow Concrete Building Block Company, Washington, D. C.

Stevens Cast Stone.

In the multiplicity of machinery and methods for making cement blocks and artificial stone the earliest method of casting artificial stone, should not be lost sight of. This is the Stevens method,

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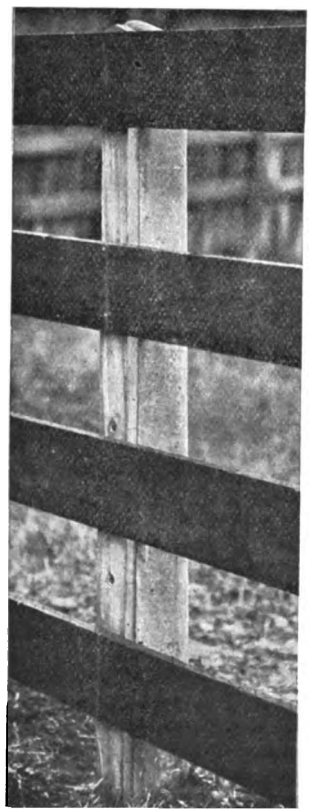
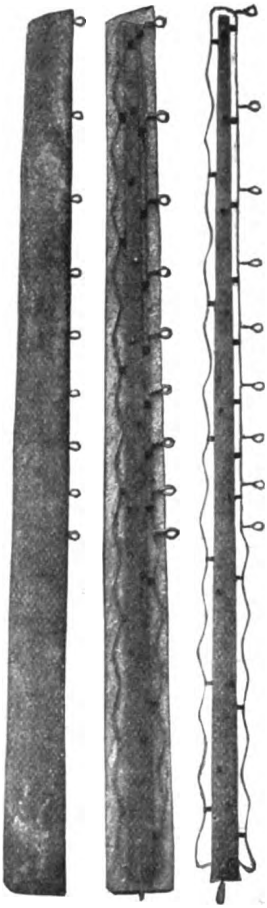
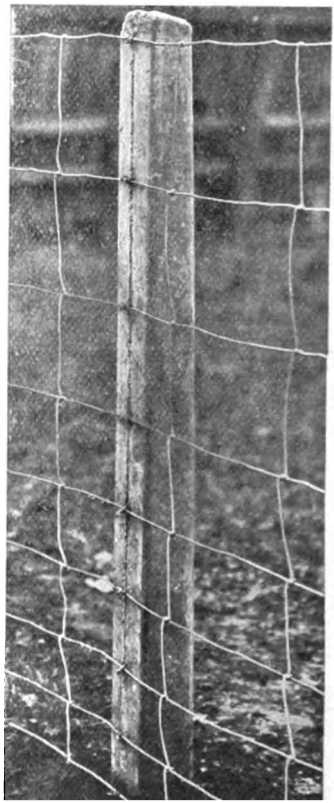




The Post.
Section of Post.
Trussed Core of Post.



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using sand molds and concrete wet enough to pour into the molds and fill them properly. The development of this method whereby sand cores are used in making blocks, makes it possible to use a minimum of expensive forms. Metal cylinders or prisms surround the sand cores during the process of forming the stone, and they can be removed as soon as the stone is finished, leaving the sand in place to support the concrete until it has set. The Stevens Cast Stone Company, 808 Chamber of Commerce, Chicago, Ill., controls this method. It also claims a patent covering its most popular form of block, which is two slabs connected by posts or piers of concrete, all made at the same time and of the same material.

A Portable Cement Block Machine.

Pettijohn Brothers of Terre Haute, Ind., have put on the market a new machine for making cement concrete blocks for which they claim several advantages, such as making the blocks on the floor, quick changes of face plate, absence of springs, levers, cogs or gears. The blocks are made on the spot where they are to remain for curing and the machine is taken away from the completed block and set up in position for the next block. Iron pallets or planks for moving the blocks are therefore not necessary. The machine is simple, light and easily moved.

An Everlasting Cement Post.

A new cement post is put on the market by Leverett A. Pratt of Bay City, Mich., which has some points of interest. The core of the post is a strip of wood trussed with No. 8 galvanized wire which has projecting loops at proper intervals to serve as fasteners for the wire or boards used for fencing material. This core, with its attached wire, is held in proper position in the galvanized iron mold, which is set on end. Concrete of cement, sand and gravel or broken stone is mixed wet enough to pour and the mold is then filled, making a firm, non-porous stone post with a smoothly finished surface. The flask is then hung up until the post is cured ready for the market. A wire fence may be attached directly to the wire loops projecting from one surface of the post. A board fence may be similarly attached or a nailing strip can be attached to the post to which the fence boards may be nailed. Concrete posts do not rot, burn or corrode, and can be set so that they will not be lifted by the frost. The cuts on the opposite page show the construction of the post.

The Value of Advertising.

The Noyes F. Palmer Manufacturing Company put on the market one of the earlier machines for making concrete building blocks, which it claims as the original adjustable mold press for making hollow or solid blocks. After a year's use of the advertising pages of Municipal Engineering Mr. N. F. Palmer says that he knows of no publication giving so much space to the subject and he gives the magazine a great share of the credit for his monthly rush of correspondence, which has now come from nearly eight hundred different localities. The results of the advertisements and the correspondence seem to be equally satisfactory to buyer and seller of machines.

Trade Publications.

The Universal Safety Tread Company, 45 Broadway, New York, describes in a catalogue their method of giving a lead surface for travel on steps for cars, stairways, ladders, etc.

Worthington meters are listed in a little descriptive catalogue of Henry R. Worthington, 114 Liberty-st., New York.

The latest catalogue of the Jeffrey Manufacturing Company, Columbus, O., is No. 57A, describing their machinery for the sawmills, lumber and wood-working industries.

The Pope Manufacturing Company, Hartford, Conn., sends a valentine as a reminder of the coming season for its wares.

Calendars have been received from the National Electric Company, Milwaukee, Wis.; the American Cement Company, Philadelphia, Pa.; F. L. Smidth & Co., New York City; Troy Public Works Company, Utica, N. Y.

Julian Scholl & Co., 126 Liberty-st., New York City, send circulars regarding their reversible horse rollers and the Babcock hardpan plow.

TRADE NOTES.

ASPHALT.

The Whippell heirs of Kentucky have made application for the appointment of a receiver for the Federal Asphalt Company, claiming that the company has not

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a clear title to the land on which the rock asphalt is mined. The claims aggregate $15,000.

Judge Kohlsaat appointed the Chicago Title & Trust Company receiver in bankruptcy of the assets of the Federal Asphalt Company, Feb. 19. The petition for a receiver alleges that the company has been insolvent for more than four months, and sets forth several acts in bankruptcy as having been committed by members of the company, one of which is that the company paid a bill to the Central Coal & Iron Company, preferring that company over other creditors. It is also alleged that the corporation's liabilities are between $325,000 and $475,000, and that the assets are considerably below this mark; that Joseph Huffaker and William L. Breyfogle claim to own a first mortgage on the property of the asphalt company for $100,000, and that other liabilities reach a total of more than $300,000. The assets of the company are said to include a large tract of land in Kentucky, where the concern's principal holdings are located, sundry stores containing merchandise, and accounts and bills receivable to the amount of $40,000.

The C. A. Brockett Cement Co., Kansas City, Mo., has attached the tools and equipment of the Federal Asphalt Company of Chicago on a claim of $1,000.75 for cement furnished that company.

BRICK.

The Winamac Cement Pressed Brick Company of Winamac, Ind., has been incorporated to manufacture cement-sand building blocks, and other articles which can be made from a combination of cement and sand. The incorporators are Samuel A. March, George T. Bouslog, Milo E. Bond, Mont M. Hathaway and Charles L. Weeks.

The Amsler Engineering Company, Empire Building, Pitsburg, Pa., has been incorporated under the laws of Pennsylvania to build blast, open hearth, heating and melting furnaces, and to conduct a general contracting business in brick and concrete. The company has secured a contract from the American Steel and Wire Company to erect one furnace and four hot blast stovoes at Cleveland, O. W. O. Amsler, president; A. C. Davis, treasurer.

A plant for the manufacture of sand brick will be constructed at Ft. Smith, Ark., under the direction of J. T. Rabb, a millwright of Bonham, Tex.

A vitrified brick and sewer plant is said to be needed at Paris, Tex.

CEMENT.

The Guarantee Cement and Stone Company, northwestern sales agents for the cement department of the Illinois Steel Company of Chicago have moved to 704 New York Life building, Minneapolis, Minn.

The Milwaukee Crushed Stone Company, Milwaukee, Wis., has been incorporated to manufacture, buy and sell stone, lime and cement by Carl F. Geilfuss, Joseph V. Quarles, jr., and Arthur Wenz.

The Western Cement Company was awarded the contract for furnishing the city of Detroit, Mich, with natural cement during the year at 62 cents per barrel.

The American Cement Post Company has been organized at Marshall, Mich., and will be licensed by trustees of basic patents on fence and other posts of cement to manufacture such products throughout the United States. The first plant will be established at Grand Rapids, Mich. The officers of the company are: President, S. F. Dobbins, Marshall; vice-president, F. A. Stewart, Marshall; secretary and manager, M. Gray, Marshall.

The Ajax Portland Cement Company, recently incorporated by Edward H. and Hiram C. Bennett of New York City and Harry H. Starrett of Bayonne, N. J., has purchased the Tice-McCray estate, one mile west of Pattenburg, N. J., and will open a quarry and establish a cement plant.

The Cincinnati Cement and Blacking Company, Cincinnati, O., has been incorporated by H. H. Patton, F. S. Patton, A. F. Ryan, W. Hughes and J. A. Carr.

The Logan Portland Cement Company is preparing to build a cement plant at Fenton, Mich., according to press reports.

The Portland Cement Construction Company, Milwaukee, Wis., has been incorporated by Charles Becker, William Grell and Charles B. Frick.

The Anadarko Plaster and Cement Company, Anadarko, Okla., has been incorporated by Homer W. Dunbar, H. G. R. Gillette, J. D. Thompson, James F. Stick, T. B. Page, J. G. Gallagher, George Baker, J. E. Tarrington, J. D. Nicholson, W. J. Lacy and A. W. Koontz.

The Gulf States Portland Cement Company, Huron, S. D., has been incorporated.

We are advised by the Edison Portland Cement Company that the works at New Village, N. J., which have been for some time past under construction, are now completed and in operation. The plant was designed and built under the direct supervision of Thomas A. Edison, the well-known inventor, and contains many novel and ingenious appliances, resulting in great economies in the handling of material, and in uniformity, fineness and product of exceedingly high grade. Owing to superior scientific methods employed, the company is in position to guarantee unusually fine grinding, over 85 per cent. passing 200 mesh and 98 per cent. passing 100 mesh. The present capacity of the plant is 1,500 barrels daily. Much of the equipment, however, is on basis of 10,000 barrels daily, and by June 1 it will have a capacity of 3,000 barrels daily. The plant will gradually be increased by additional units representing 1,500 barrels

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daily capacity until the ultimate limit of 10,000 barrels daily will be reached.

The charter of the Iola Portland Cement Company of Dallas, Tex., was filed Jan. 30, at Austin, by Edwin M. Reardon, Jas. C. Duke, of Dallas; Sheldon H. Bassett, St. Louis; Edgar H. Ryan, Davenport, Ia.; Chas. H. Pope, Moline, Ill., the company having acquired the properties of the Texas Portland Cement Company.

The contract for furnishing 4,300 barrels of Portland Cement for use in the extension of the concrete breakwater at Marquette, Mich., was awarded to F. B. Spear & Sons, at $1.79 a barrel.

A new cement company has been organized, according to press reports, to build a plant one-half mile north of the Omega Company, in Scipio, Mich. The new company will be known as the Delta Cement Company. The officers of the company are as follows: President, Wesley Sears, Jackson, Mich.; vice-president, Prof. D. E. Haskins, Scipio, secretary and treasurer, Dr. E. R. Esplo, Jonesville.

In the United States Circuit Court at Baltimore, Md., February 5, the Carolina Portland Cement Company obtained a verdict for $4,000, and Ira C. Hutchinson for $2,000 damages against the Maryland Cement Company. The Carolina Portland Cement Company alleged a breach of contract for the delivery of 25,000 barrels of cement in 1902. The amount claimed was $18,000. The Maryland Cement Company claimed that it could not comply with the contract because of inability to secure the necessary slag to make the cement. The verdict of the jury was for the difference of 40 cents a barrel, which it was compelled to pay on 10,000 barrels of cement. Ira C. Hutchinson, in the second suit, claimed $5,000 commission on the cement in the first suit and other sales. The first case was tried before a jury, and the latter before a judge without a jury.

Press reports from Galveston, Tex., that Judge S. W. Jones, referee in bankruptcy, has received from Jens Moller, trustee in bankruptcy of the Texas Portland Cement & Lime Company, a report of the sale to Edgar H. Ryan, of Davenport, Ia., in behalf of the Iola Portland Cement Company for $250,000, of the total assets of the bankrupt company. A majority of the creditors, representing $177,322 out of a total of $193,973 joined in a request for speedy confirmation of the sale. The purchaser is to pay the sum of $223,513 clear of all incumbrances on said properties upon the following terms: $100,000 thereof in ready money upon the delivery of the properties to the purchaser; $15,000 in cash within 30 days thereafter, and the residue within 30 days thereafter; deed to be held in escrow until all the purchase money shall have been paid. The purchaser has also assumed $26,486 worth of liens, which makes the total sale aggregate $250,000. Judge Jones says that the bankrupt company will pay its indebtedness dollar for dollar with interest, and will leave from $25,000 to $40,000 to be distributed as surplus among its stockholders. He had approved the trustee's report of sale, and as soon as the trustee reports to him the expenses of the first dividend of at least 50 per cent. will be declared. Judge Jones is gratified at the outlook for the stockholders owing to the splendid physical condition of the plant and the satisfactory terms of sale, and says that he has never known a bankrupt concern to exhibit a better financial showing.

CONCRETE BLOCKS.

A cement company is being organized at Watertown, S. D., and the names of two or three foremen and the same number of finishers for sidewalk construction are desired. Lee Stover.

The American Concrete Construction Company of Cincinnati, O., has been incorporated by Charles H. Davidson, George P. Walker, J. H. Crawford, C. M. Foster and Charles H. Urban.

The Building Block Manufacturing Company, Minneapolis, Minn., has been incorporated to manufacture hollow concrete building blocks by Samuel Whaley, William F. Porten and Charles W. Buechner of St. Paul and James W. Cooper of Minneapolis.

I. Hawk, Estherville, Ia., contemplates erecting building for the manufacture of cement building blocks.

Charles Atkinson has purchased the interest of I. S. Binford in the Brookings Cement Block Company, Brookings, S. D.

Cement sidewalk blocks will be manufactured by Adams Bros. at Little Falls, Minn.

The Cement Products Company, Webster City, Ia., manufacturers of hollow concrete building blocks, will add cement posts to their product this year.

The Building Material Manufacturing Company, Warsaw, Ind., has purchased an outfit from the Miracle Pressed Stone Company of Minneapolis, Minn., and will manufacture concrete building blocks. The plant will be installed on Winona Lake, 3 miles east of Warsaw. F. F. Lehew will be superintendent.

Russell Brothers, Waverly, Ia., have completed arrangements with the Miracle Pressed Stone Company for an outfit to manufacture the Miracle hollow concrete building block, and have purchased the exclusive right for Butler and Bremer Counties.

The Wapakoneta Cement Block Company, Wapakoneta, O., has been incorporated to manufacture hollow concrete blocks for building purposes.

A. J. Stacer of Chicago has purchased the patent for a cement mold to be used in manufacturing building blocks, and two engines of Charles E. Shumway of Albion, Mich.

The Cement Building Block and Stone Company, Springfield, O., has been organized by Joseph Bolan, Philip Beninger and James Powers, and will establish a plant for the manufacture of cement building blocks.

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The Utopian Concrete Block Company, Denever, Colo., has been incorporated by A. C. Haffner, Thomas A. McMurtrie and Charles D. Baker.

The Freeport Concrete Construction Company, 302 Wilcoxen Building, Freeport, Ill., has been organized to manufacture hollow concrete building blocks, by W. H. Shones, J. A. Gale and C. K. Meyers.

A cement brick-making machine is being made for the Delaware Cement Products Company of South Wilmington, Del., by Charles Heinel.

A company has been incorporated at Waterloo, Ia., for the manufacture of cement blocks, with J. H. Stewart as president; George L. Dixon, vice-president; W. M. Law, secretary.

LIGHTING AND POWER.

The Safety Automatic Gas Light Cutoff Company, Kaukauna, Wis., has been incorporated by A. G. Koch, J. M. Jansen, C. A. Walquist and Peter Rademacher.

The United Light & Traction Company, Camden, N. J., has been incorporated to generate electricity for light and power, by M. Leon Berry, Norman Grey and W. B. Walcott.

The National Gas. Electric Light & Power Company, 15 Exchange Place, Jersey City, N. J., has been incorporated to acquire, lease. construct, develop. improve, maintain, operate and deal in lights and franchises of or relating to any and all public utilities. The incorporators are James T. Lynn, Frank K Pelton and Kenneth K. McLaren.

The Massachusetts Electric Supplies Company, Portland, Mass., has been organized to manufacture and deal in electrical apparatus, by Charles J. Nichols and Edward H. Lounsbury.

Newly incorporated lighting companies: Municipal Electric & Construction Company, St. Louis, Mo.—Chas. G. Diemunsch, William Gottlieb and Joseph Block; The City Gas Company, Washington, Ind.—Bascom Parker, Jules Dick and E. T. Taylor; Monterey Light & Power Company, Jersey City, N. J.—Kenneth K McLaren, Robt. L. Hogust and Roger H. Williams; Virden Electric Light Company, Virden, Ill.—J. N. Hairgrove, U. G. Tucker and C. W. Carn; Aurora, Elgin & Chicago Electric Light, Heat & Power Company, Aurora, Ill.—E. C. Faber, J. T. Huntington and W. P. Harvey.

The Nernst Lamp Company has removed its offices from Pittsburg to the Nernst Building, Detroit, Mich. The company will hereafter confine its business to the territory of Michigan, the northwestern part of Ohio and the northeastern part of Indiana.

MISCELLANEOUS.

George M. Pierce, who has for the last three years been secretary and treasurer of the Duplex Manufacturing Company of Cleveland, O., has severed his connection with that company and is now associated with the Pierce Supply Company, American Trust Building, Cleveland, O. The new company manufactures a full line of cast-iron goods for street improvements.

The Decatur Hydraulic Stone and Hard Plaster Company, Decatur, Ill., has been incorporated to manufacture artificial stone and hard plaster, by George Ferre, John Oren and B. F. Stanley.

The Pressed Stone Manufacturing Company, St. Paul, Minn., has been incorporated by George W. Oakes, W. S. Darby and B. S. Oakes.

The Northwestern Artificial Stone Works, Huron, S. D., has been incorporated.

The construction of a plant for the manufacture of artificial stone is contemplated at New Decatur, Ala., by parties from Birmingham and Decatur.

The Nelson Bros.' Paving and Construction Company, Minneapolis, Minn., has been incorporated by John A. Nelson, N. J. Nelson and Harvey V. Smith.

The Universal Stone Machine Company, Jersey City, N. J., has been incorporated by Albert Crockel, S. E. Atwater and John W. Walker.

At the annual meeting of the Acme Road Machinery Company held at the offices of the Corporation at Frankfort, N. Y. on Thursday, January 28, 1904, the following directors were elected for the ensuing year: W. A. Cook, D. B. Cook, James Dempsey, T. G. Ingersoll, J. W. Jones, Philander Pollock, Alonzo Schaupp. At a subsequent meeting of the directors of the company the following officers were elected: President, Philander Pollock; vice-president, A. Schaupp; secretary and treasurer, James W. Jones; general manager, W. A. Cook.

SEWER PIPE.

Pittsburg capitalists have purchased 20 acres of the McGrew farm, according to press reports and will locate thereon a sewer pipe plant.

The Mexican Sewer Pipe Company, Cleveland, O., has been incorporated by J. E. Morley, E. A. Foote, C. H. Gale, L. H.

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IMPROVEMENT AND CONTRACTING NEWS

PAVING.

South Bend, Ind.—The Barber Asphalt Paving Company has dismissed its suit against this city in the United States District Court. The original basis of the action was a claim against the city for $3,000 on the ground of services rendered in the paving of street and alley crossings. The company had given the city a receipt in full for the work, but afterward decided that it was entitled to interest in amounts ranging from $150 to $200.

CONTEMPLATED WORK.

Athens, Ga.—Paving is proposed for Barber-st.

Racine, Wis. — Douglas-ave. may be paved. Mayor Nelson.

Terre Haute, Ind.—Brick paving is contemplated for Lafayette-ave.

Asheville, N. C.—Macadam paving is contemplated for Haywood road.

Wichita, Kas.—An ordinance has been passed for paving William-st.

Thomasville, Ga.—Estimates are desired for constructing brick paving.

Monterey, Cal.—About 3 mls. of grading, paving and sidewalks is contemplated.

South Bend, Ind.—The residents on Ohio-st. have petitioned for brick paving.

Ottumwa, Ia.—S. Green and Marion-sts. are to be paved with brick on concrete.

Fairbanks, Ind.—This township voted to construct about 9 mls. of gravel roads.

Millville, N. J.—Bids will be asked in May for street paving. George F. Payne, mayor.

Galveston, Tex.—Brick paving is conplated for Avenues E and F and Twenty-first and Twenty-fourth-sts.

Iola, Kas.—A resolution has been adopted recommending the paving of the alley in block 59.

East St. Louis, Ill.—Paving is contemplated for Nineteenth-st., from State-st. to St. Clair-ave.

Pana, Ill.—(Special).—Bids will be asked for brick paving on concrete base early this spring.

Trenton, N. J.—A resolution has been introduced asking for Federal co-operation in road building.

Oshkosh, Wis.—Asphalt paving is favored for Jackson-st., according to local press reports.

Paris, Ky.—This city is preparing to pave Main-st., from First to Tenth, with asphalt or concrete.

Chattanooga, Tenn.—This city and Jasper will be connected by a macadamized road before next winter.

Anaheim, Cal.—Bids will be asked for in April for constructing cement walks and curb. E. B. Merritt, cy. clk.

Mankato, Minn.—The county board will take action March 22 on the proposed Strand's ravine road matter.

Bay City, Mich.—An ordinance has been passed regulating the construction of stone, cement and brick sidewalks.

Allentown, Pa.—Ordinances have been passed and $20,000 appropriated for street paving. H. F. Bascom, cy. engr.

Moline, Ill.—The village council of East Moline voted, Feb. 15, to construct 10,000 ft. of plank sidewalks.

Hancock, Mich.—Plans and specifications have been received for the extension of the asphalt paving on Quincy-st.

Covington, Ky.—Scott-st. will be paved with Kreodone block, and Banklick and several other streets with brick.

Red Bluff, Cal.—The town trustees have ordered constructed cement sidewalks on both sides of Walnut-st. from Main-st. to the depot.

Huntsville, Mo.—The citizens are in favor of bonding for $10,000 or $20,000 for the purpose of macadamizing the principal streets.

Sherman, Tex.—(Special.)—Charles E. Hayden, cy. engr., says about 4,150 sq. yds. of brick paving, on broken stone foundation, is contemplated.

Chicago, Ill.—New sidewalk ordinances, covering 6 mls., are being prepared. The material will be cement, cinder or stone.

Augusta, Ga.—The question of paving Broad-st. with asphalt, vitrified brick or bitulithic pavement is being considered. Mayor Allen.

Richmond, Ind.—A resolution has been passed for constructing cement curb and gutters on N. Thirteenth and N. Fifteenth-sts. Cy. engr., Weber.

Mooresville, Ind. — (Special.) — D. E. Dolen, town clk., says that contracts will be let about April 1, for about 15,000 sq. ft. of cement walks.

Massillon, O.—Estimates have been prepared for paving as follows: Factory, Canal and Cherry-sts., brick, $9,013; East and Hill-sts., $8,611.

Cincinnati, O.—An ordinance has been passed for paving Schoedinger-ave., from Jonte-ave. to Lierman-ave. with brick. H. L. Gordon, prest. coun.

Kansas City, Mo.—About two and a half miles of asphalt and macadam paving is contemplated on Independence-ave., from Topping-ave. to Blue River. D. W. Pike, cy. engr.

Ashland, Wis.—Council has decided to pave Third-st. and Seventh-ave with macadam, in accordance with the wishes

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of the property owners. W. W. Fisher, cy. clk.

Denver, Colo.—Surveys and estimates have been completed for grading and paving about four mls. of streets and boulevards in Montclair, with disintegrated granite.

San Francisco, Cal.—A resolution has been passed for constructing artificial stone sidewalks on Point Lobos-ave. from Williamson-st. to First-ave.

Albany, N. Y.—An ordinance was passed, Feb. 15, over the protests of the property owners, for paving Union-st., between Madison and Hudson-aves., with granite block.

Springfield, O.—City engineer Sieverling has been directed to prepare plans and specifications for paving portions of Center, Fisher, Columbia, Main and Pleasant-sts.

Oakland, Cal.—A bond issue of $3,500,000 is favored, and among the improvements proposed is $230,000 for boulevards and $100,000 for cross-walks and culverts.

Ashland, Ky.—(Special).—Chas. D. Boggess, cy. engr., says that bids will be received about March 1 for 35,600 sq. yds. of brick paving on 6-in. concrete base. W. A. Ginn, Mayor.

Washington, Ia.—Resolutions have been approved for paving Main, Washington, Marion and Iowa-sts. and certain alleys with vitrified brick. A. N. Alberson, Mayor; Hugh H. McCreery, cy. clk.

La Crosse, Wis.—Resolutions have been passed authorizing brick paving on Jay and Mill-sts., and macadam paving on Avon, St. James, Market, Ninth, Eleventh and Jackson-sts., West-ave. and certain alleys.

St. Joseph, Mo.—The Barber Asphalt Paving Company, which had the contracts for resurfacing 4 streets in the business district, has cancelled its contracts, and the work will be re-advertised.

Hancock, Mich.—(Special).—Hon. A. J. Scott, Mayor, says that this city will pave about 8,000 sq. yds. of Quincy-st. with asphalt. The date for receiving bids has not yet been fixed, but will be about May 1.

Louisville, Ky.—The Fiscal Court decided, Feb. 9, to ask for bids for the reconstruction of the Shelbyville and Bardstown pikes with bitulithic pavement for a distance of 1 mile each from the city limits.

Cleveland, O.—An ordinance has been passed providing for vitrified brick paving on Atwater-st. from Miles-ave. to Pratt-st., and dressed block Medina stone paving on Flint-st. from Detroit to Washington-sts. Peter Witt, cy. clk.

Ashland, Wis.—(Special).—W. W. Fisher, cy. clk., says that about 25,000 sq. yds. of asphalt paving and about 2 miles of macadam paving is contemplated. Bids have not yet been advertised, as the plans and specifications are not completed.

Charlotte, Mich.—(Special).—Murl H. DeFoe, cy. clk., says that Riggs & Sherman of Toledo, O., have been engaged to prepare plans and specifications for paving, but the material or time for receiving bids has not yet been determined upon, but will be at an early date.

Harrisburg, Pa.—(Special).—About 100,000 sq. yds. of paving, which may be sheet asphalt, asphalt block, brick and Warren's bitulithic pavement, is contemplated. With the exception of Warren Bros. bitulithic macadam these pavements will be laid on concrete base. M. B. Cowden, cy. engr.

Menominee, Mich.—Albert Hass, cy. engr., has prepared estimates for street paving as follows: Grand-ave.—brick, $28,372.85; bitulithic, $26,091.60; macadam, $15,054.10; asphalt, $28,372.85. State-st.—brick, $19,960.95; bitulithic, $18,193.90; macadam, $10,420.20; asphalt, $19,960.65; Spies-ave., Macadam, $2,204.75; Michigan-ave., macadam, $6,271.50; Jenkins-st., macadam, $2,899.75; Pine-st. and Wells-ave., macadam, $1,832.50; Dunlap-ave., macadam, $1,933.75; Williams-ave., macadam, $1,895.50. Bids will be received in March for the work.

La Salle, Ill.—(Special).—C. M. Rickard, cy. engr., says estimates for brick paving and stone curb for 1904 are as follows: Crosat-st., 10,802 sq. yds., $22,499.94; St. Vincent-st., 10,706 sq yds., $22,499.94; Fourth-st., 7,826 sq. yds., $15,460.14; Tonti-st., 8,593 sq. yds., $16,470.91; Ninth-st, 15,285 sq yds., $29,285.41; Chartres-st., 6,611 sq. yds., $13,601.02; Joliet-st., 18,041 sq. yds., $34,490.20; total, $153,448.58.

CONTRACTS TO BE LET.

Mt. Holly, N. J.—Bids are asked until March 1 for one-third mile of macadam street paving. W. N. Stewart, cy. clk.

Greensburg, Ind.—Bids are asked until 1 p. m. March 7 for constructing a gravel road. Frank E. Ryan, co. audt.

Port Huron, Mich.—Bids are asked until 11 a. m. March 7 for repaving Butler, Broad and S. Military-sts.

Steubenville, O.—Bids are asked until March 10 for grading and macadamizing Neel free turnpike. R. S. Neel.

Muncie, Ind. — Bids are asked until March 1 for paving Jackson-st. with crushed stone. J. E. Mitchell, town clk.

Cincinnati, O. — Bids are asked until March 12 for improving Bloome road, in Sycamore township. E. L. Lewis, co. audt.

Brownstown, Ind.—Bids are asked until March 7 for constructing 2 miles and 4815 feet of gravel roads. Bd. co. comrs.

Lawrence, Kas.—Bids are asked until March 7 for grading, curbing and paving New Hampshire-st. Samuel P. Moore, cy. clk.

Sidney, O.—Sealed bids are asked until 12 m. March 5 for the Bodey pike improvement in Van Buren twp. Charles Counts, co. engr.

Hartford City, Ind.—Bids are asked until 8 p. m. March 3 for paving High, Main and Jefferson-sts. with brick. William Harley, cy. engr.

Versailles, Ind.—Bids are asked until 12 m. March 8 for building 9 miles and 2126 feet of macadamized roads. Nicholas Volz, co. audt.

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Louisville, Ky.—Bids are asked until March 15 for constructing 2¼ miles of bitulithic or tar macadam road. R. H. Young, co. surv.

Amsterdam, N. Y.—Bids are asked until March 5 for further improvement of Mohawk River turnpike, No. 108. Edward A. Bond, state engr., Albany.

North Yakima, Wash.—Bids are asked until March 7 for grading and graveling 1 mile of road in Moxee Valley. W. I. Lince, chmn. bd. co. comrs.

Lawrenceburg, Ind. — Sealed bids are asked until 12 m. March 7 for constructing a free macadamized road in Clay township. Charles M. Beinkamp, co. audt.

Crown Point, Ind.—Bids are asked until March 7 for constructing about 6 miles of gravel roads. Michael Gimmer, co. audt.

Logansport, Ind.—Sealed bids are asked until 2 p. m. March 10 for constructing gravel roads in Deer township. Terrence A. McGovern, chmn. bd. comrs.

Ottawa, Kas. — Bids are asked until March 2 for grading, concrete curbing and 50,000 sq. yds of vitrified brick paving. John C. Quin, cy. clk.

Washington, Ia.—Bids will be received until March 3 for paving N. Marion-ave. from the public square to Railroad-st. A. N. Alberson, mayor; Hugh H. McCleery, cy. clk.

Brownstown, Ind.—Bids are asked until March 7 for constructing a gravel road on the township line between Jackson, Brownstown and Washington twps. Asbury H. Manuel, co. audt.

Washington, Ind.—Bids are asked until March 8 for constructing and improving certain roads in the towns of Montgomery and Elnora. W. H. McCarte, chmn. co. comrs.

Winamac, Ind.—Sealed bids are asked until 12 m. March 8 for improving 31,708 ft. of the Telephone road, and 31,710 ft. of the Winamac and Medaryville road. P. A. Follmar, chmn. co. comrs.

Muscatine, Ia.—Sealed bids are asked until 7:30 p. m. March 3 for 31,300 sq. yds. of brick paving in impvt. dist. No. 22, and 27,39) sq. yds. in dist. No. 21. James J. Ryan, cy. engr.

Mt. Clemens, Mich.—Sealed bids are asked until 6 p. m. March 7 for regrading and repaving Cass-ave. and Walnut and Grand-aves. with brick, asphalt and bituminous macadam. William F. Kracht, cy. clk.

Ottumwa, Ia.—Sealed bids are asked until 7:30 p. m. March 7 for repaving and reconstructing Main-st. from Jefferson to Washington with vitrified repressed paving brick or blocks. H. P. Keyhoe, chmn. st. com.

Geneva, N. Y.—Sealed bids are asked until 10 a. m. March 3 for 10,500 sq. yds. of asphalt, asphalt block and brick paving on concrete, macadam, tar macadam and asphaltic bituminous macadam paving. W. S. Wood, secy B. P. W.

Mansfield, O.—Sealed bids are asked until March 2 for constructing 15,480 lin. ft. of combination cement sidewalk, curb and gutter, 730 lin. ft. separate cement curbing, 5,330 ft. separate cement walk, 800 lin. ft. cement curb and gutter. Briggs Real Estate Company. Also 19,280 sq. yds. of macadam paving.

Shereveport, La.—Sealed bids are asked until 7 p. m. March 21 for paving twenty-nine streets with brick, asphalt and Warren Bros.' bithulithic pavement, or similar pavements. Each street is to be bid on separately. C. G. Rives, compt.

Portsmouth, O.—Bids are asked until March 8 for 55,517 sq. yds of paving, 22,765 lin. ft. curbing, 2,658 ft. edging, twenty-five manholes, 19,805 ft. sidewalks relaid, on Fourth, Market, N. Waller and Clay sts. Filmore Musser, cy. audt.

CONTRACTS AWARDED.

Decatur, Ind.—The contract for macadamizing Thirteenth-st. was awarded to Fred Hoffman for $4,515.

Toledo, O.—The contract for paving Wakeman-st. with Massillon block was awarded to Bodette & Sheehan for $5,384.

Atchison, Kan.—S. M. Missmer & Co., city, secured the contract for paving Mound-st. with brick for $12,828.

Duluth, Minn.—The contract for paving N. Twelfth-st., from Banks to Ogden-ave., was awarded to Warren Bros. of Boston.

Marion, Ind.—The contract for constructing the Brown and Sanderman roads was awarded to Nathan P. Medlin for $9,999.

Elwood, Ind.—The contract for constructing the Hanshaw gravel road has been awarded to Crall & Daniels for $26,747.

Los Angeles, Cal.—The contract for paving W. Citrus-ave. and W. State-st. was awarded to the Barber Asphalt Paving Company.

Rushville, Ind.—Philip Wilk was awarded the contract for macadamizing 3¾ mls. of pike in Richmond twp. for $12,775.

Crookston, Minn.—P. McDonnell of Duluth has been awarded the contract for paving several streets in this city with macadam.

Nashville, Tenn.—The contract for furnishing granite paving blocks was awarded Feb. 10 to Francis Jones & Co. at $45 per 1,000.

St. Paul, Minn.—L. G. Washington was awarded the contract for all stone and cement sidewalks to be built during 1904 for $40,396.

Crookston, Minn.—The contract for paving several streets with macadam was awarded to P. McDonnell of Duluth at $1.68 a sq. yd.

Downers Grove, Ill.—The lowest bids submitted for paving Main-st. with brick was that of A. E. Rutledge of Rockford for $12,593.94.

Savannah, Ga.—The contract for furnishing 40,000 sq. yds. of vitrified brick was awarded to the Georgia Brick and Clay Company of Augusta, for approximately $40,000.

Normal, Ill.—The contract for 3,700 sq yds. of brick block paving was awarded to Geo. W. Bansom of Amboy at $2.05 a sq. yd.; 1,760 lin. ft. cement curb, 34 cts.; total, $7,800.

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Toms River, N. J.—The contract for constructing 3¼ mls. of gravel road in Union twp. was awarded Feb. 9 to E. King of Parkertown and Daniel T. Cramm of New Gretna fo $9,164.

Newark, N. J.—The contract for repaving the roadway of the Jackson-st. bridge with creo-resinate wood block pavement was awarded Feb. 118 ro David E. Olds, 103 Grafton-st., city, for $8,250.

St. Paul, Minn.—The contract for constructing and repairing cement sidewalks during 1904 was awarded to J. G. Washington for $40,396. The James Forrestal Company will build woooden walks for $15,010.

gravel road extensions have been award.

Washington, Ia.—The contract for 6,300 sq. yds. of brick paving on N. Iowa-ave. was awarded, Feb. 9, to the McCarthy Stone Company at $1.49½ a sq. yd. The work will require about 2,000 ft. of curbing and gutter.

Harrisburg, Pa.—The first contract for the reconstruction of a road under the new road law was awarded, Feb. 11, to Frederick Robinson of Meadville for $11,540.20. The road will extend from Titusville to Hydetown, a distance of 7,708 ft.

Vigo, Ind.—Contracts for constructing the L. W. Bailey and George Sanders ed to George J. Singer for $3,866, and Cook & Brocksmith for $6,266 respectively.

Brownstown, Ind.—Contracts have been awarded for 6 mls. of macadam road in Grassy Fork, Washington and Browntown twps. as follows: De Golyer & Moritz, Seymour, $1,622; Samuel Smallwood, Ewing, $4,056; Wm. H. Shields, Seymour, $1,468.

Peoria, Ill.—M. E. Case was awarded the contract for 10,152 sq. yds. of brick paving on Washington-st., at $1.24 a sq. yd.; exca., 24 cts, a cu. yd.; protection curb, 30 cts.; stone curb, 5x22, 74 cts. a lin. ft.; total, $16,356.

Bay City, Mich.—The stone road commission awarded contracts for supplies, Feb. 20, as follows: Gravel, Peter Malcolm of Saginaw, $1.15 a cu. yd.; crushed hard heads, Legg & Harvey of Oakley, $2.05 a cu. yd.; Bayport limestone, Wallace Stone and Lime Company of Bayport, $1.40 a cu. yd.

Kalamazoo, Mich.—Bids were submitted Feb. 15 for paving South and Park-sts. and Park-place, from W. W. Hatch & Son of Goshen, Ind., and J. E. Conly, on brick; Central Bitulithic Company and Barber Asphalt Paving Campany, on bi-

SEWERS.

Plainfield, N. J.—The Cameron Septic Tank Company has filed suit against this city for infringements of that company's patents in the local sewage dispocal plant.

CONTEMPLATED WORK.

Brainerd, Minn.—A sewer is desired in the Second ward.

Gulfport, Miss.—A sewerage system will be established.

Liverpool, O.—The extension of the sanitary sewers is contemplated.

Celina, O.—The question of a sewerage system is again being agitated.

Michigan City Ind.—A three-foot brick sewer on Franklin-st is contemplated.

Bellefontaine, O.—The question of a sewerage system will be considered soon.

Dallas, Ore.—Plans and specifications for a sewerage system will be prepared.

Centerville, Ia.—A complete sewerage system is proposed. T. W. Meers, cy. clk.

Waukesha, Wis.—Council has decided to build a sewer on Rosemary-st. Mayor Harding.

Los Angeles, Cal.—Bids will be asked at once for constructing a storm drain on Hill-st.

Saugerties, N. Y.—The question of a sewerage system will probably be voted on this spring.

Mainistee, Mich.—Pipe sewers will be constructed in Filen, Washington, Hancock and Sixth-sts.

Seneca Falls, N. Y.—The question of building a sewerage system will be voted on in March.

Grantville, Ga.—The construction of sewers is contemplated this spring. F. T. Meacham, Mayor.

Naperville, Ill.—A resolution has been passed favoring the construction of a sewerage system.

Los Angeles, Cal.—Bids are to be asked for constructing the outfall sewer. H. H. Stafford, cy. engr.

Elmwood, O.—The city engr. has been directed to prepare plans and specifications for a sewerage system.

Covington, Ky.—The Willow Run Sewer will be continued from Sixteenth-st. to the south corporation line.

Hamilton, O.—About 8 miles of sanitary and storm sewers is contemplated, according to press reports.

West Hartford, Conn.—Bids will be asked in March for constructing the

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mate has been prepared for a sewer on Thomas, Ocean, Oneida, Fauquier and Sinnen-sts.

La Crosse, Wis.—The council com. recommends the construction of twenty-four blocks of sewers on the North Side.

Brookings, S. D.—Plans and specifications have been filed at the city clerk's office for a sewerage system.

Glenville, O.—A storm water sewer on Ethel-st. and a sanitary sewer on Lake Shore-boulevard is contemplated.

Mishawaka, Ind.—A resolution has been adopted for the construction of a trunk sewer on Logan-st. M. W. Mix, mayor.

Longmont, Colo.—Bids will be asked soon for constructing fourteen and one-half mis. of eight to eighteeen-in. sewers. C. C. Catkins, cy. engr.

Lenox, Tenn.—J. W. Winkler is chairman of a com. to investigate the construction of a sewerage system. R. J. Rawlings, mayor.

Cloverdale, Cal.—W. T. Brush and Charles E. Humbert are members of a com. appointed to secure preliminary plans for a sewerage system.

Philadelphia, Pa.—The board of survey has approved plans for the construction of branch sewers in different sections of the city.

Oakland Cal.—The bond com of council thinks $70,000 will be necessary for reconstructing the western end of the Main Lake sewer.

Alton, Ill.—An ordinance has been adopted to construct sewers on Spring-st. from Union to Sixth, and from Fourth to Second. Mayor Brueggeman.

West, Duluth, Minn.—Enough petitions have been filed, according to local press reports, to secure a sewerage system for West Duluth.

Hartford, Conn.—A resolution has been favorably reported by the bd. of aldermen appropriating $30,000 for the extension of intercepting sewers.

Perth Amboy, N. J.—New York capitalists have made a proposition to provide a sewer system and a water-works and electric light plant for South Amboy.

Urbana, Ill.—A resolution has been passed authorizing the bd. of local impvts. to secure an engineer to investigate the proposed general sewer extensions.

Waukegan, Ill.—Plans for the completion of the North Side sewer system are being discussed. A public hearing will be given on the matter March 15.

Sackville, N. B., Canada—(Special.)—Thomas R. Anderson, chmn. water and sewerage com. of count., says this town contemplates the extension of the sewerage system.

Harrisburg, Pa. (Special.) M. P. Gorgas also been authorized to prepare plans for the Illinois, B and C-st. sewers.

Palataka, Fla.—(Special.)—This city desires to secure the services of an expert sanitary engineer to come here and plat the city for a sewerage system. Address J. M. Blackwell, cy. clk.

San Jose, Cal.—The city engr. will be directed to prepare plans and estimates for constructing sewers, with manholes, storm water inlets, catch basins, etc., in Broadway-st. and San Pablo-ave.

Columbus, O.—An ordinance has been introduced authorizing an appropriation of $46,000 from the sewage disposal plant fund to be used in the construction of an experimental plant south of Moler road.

Newark, N. J.—Surveys will be made for a sewerage system in and around Newfoundland. The proposed plan includes the erection of a septic tank disposal plant below the Macopin intake, and it is believed that such a system would effectually prevent pollution of the water supply.

CONTRACTS TO BE LET.

Sumpter, Ore. — Bids are asked until April 1 for constructing a sewerage system. S. S. Start, cy. recorder.

Windom, Minn. — Bids are asked until March 14 for constructing a ditch near Mountain Lake. J. A. Brown, cc. audt.

Atlantic, Ia.—Bids will be received until March 3 for constructing 3 miles of sewers. Iowa Engineering Company, engrs.

Alexandria, Minn.—Bids are asked until 10 a. m. March 7 for constructing ditch No. 3. E. P. Wright, co. audt.

Green Valley, Ill.—Sealed bids are asked until March 8 for constructing an open ditch. D. S. Fisher, chmn. drainage comrs.

Butler, Mo.—Bids are asked until March 7 for constructing a sewage disposal plant and a sewerage system. J. L. Stanley, cy. clk.

York, Pa.—Sealed bids are asked until 7 p. m. March 1 for constructing a system of sanitary sewers. R. E. Cochran, prest. B. P. W.

Portsmouth, O. — Bids are asked until March 8 for the construction of brick and pipe sewers with twenty-five manholes. Filmore Musser, cy. audt.

Port Arthur Ont.—Bids are asked until March 28 for constructing about 7,000 feet of storm sewers and 15,500 feet of sanitary sewers. James McTeigue, town clk.

Washington, D. C. — Sealed bids are asked until March 25 for furnishing and erecting sluice gates at the sewage pumping station. H. B. F. MacFarland, chmn. Dist. Comrs.

Henderson, N. C.—Bids are asked until March 10 for constructing a sewerage system, consisting of 8 miles of 8 to 18-inch pipe sewers. H. T. Powell, secy. bd. internal impvts.

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March 2 for constructing a sewer through the northern porton of Dyker Beach Park consisting of 2,525 lin. ft. of 36, 90, 102 and 120-inch brick sewers; 11 manholes, 2,480 lin. ft. 12-in. vitrified stoneware pipe subdrain. Martin Littleton, boro. prest.

Dolgeville, N Y.—Sealed bids are asked until 7:30 p. m. March 28 for 31,000 feet 6 to 18-in. sewer, with flushtanks, manholes and lampholes; also for a large septic tank disposal plant for the system and a small disposal plant for factory, with gate house, gates, pipes and pumps complete. Julius Breckwoldt, prest. bd. sewer comrs.

Shreveport,, Da.—Sealed bids are asked until 7 p. m. March 21 for constructing 756-ft. 18-in., and 690-ft. 24-in. vitrified piper sewer; 279-ft. 30-in., 363-ft. 42-in. and 373-ft. 54-in. circular brick or concrete sewer; 40-ft. 72-in. brick or concrete sewer with manholes, catchbasins and connections complete. C. G. Rives, comt.

Marshall, Tex.—Sealed bids are asked until March 8 for constructing a system of sanitary sewers, consisting of 3,950-ft. 24-in., 5,020-ft. 18-in., 10,105-ft. 15-in., 5,320-ft. 12-in., 5,490-ft. 10-in., 19,295-ft. 8-in., 64,985-ft. 6-in. pipe, 280 anholes, 78 flushtanks, 35 tons of c. i. pipe laid with lead joints. M. S. Rice, sec'y.; J. W. Maxcy, con. engr., Houston

CONTRACTS AWARDED.

Red Oak, Ia.—The contract for a sewerage system was awarded to Shepard & Hanrahan of Des Moines, for $6,300.

San Francisco, Cal.—The contract for building a sewer in Cedar-st. was awarded to Fred Lefler, at $1.65 a lin. ft.

Belleville, Ill.—Brauch & Co. was awarded the contract, Feb. 10, for constructing a sewer on Pennsylvania-ave. for $1,700.

Bayonne, Pa.—The contract for a sewer on W. Thirtieth-st., from Avenue C to Avenue A, was awarded, Feb. 16, to D. Donovan, for $6,098.50.

Grafton, Pa.—The contract for constructing a sewer on Chartiers-ave. was awarded, Feb. 11, to V. Di Giorno & Co., of Pittsburg, for $18,280.

Berwick, Pa.—The contract for constructing a sewerage system has been awarded to Hurd, Sherman & Co. of Syracuse, N. Y., for $46,953.70.

Youngstown, O.—J. P. McCarron was awarded the contract for a sewer in Garland-ave., and Rochford & Comisky for sewers in Rigby and Pearl-sts.

Milwaukee, Wis.—The contract for machinery for the flushing tunnel works was awarded, Feb. 11, to the Allis-Chalmers Company, of Chicago, for $28,600.

Hawkinsville, Ga.—The contract for constructing a sewerage system was awarded to Hallanhan & Costello, of Augusta, and for furnishing pipe to H

St. Paul, Minn.—Sewer contracts were awareded, Feb. 15, as follows: P. J. Ryan, Plato-st., $800; Van Buren-st., $1,248; Earl-st., $676; Mendota-st., $823. D. W. Moore, George-st., $399, and Cherokee-ave., $1,-987.

Long Island City, N. Y.—Contracts for constructing sewers were awarded, Feb. 1, as follows: John Herle, Seventh-st., in Elmhurst, $6,702. Gabriel Hill, Sixth-ave., Elmhurst, $3,504; Fourth-st., Elmhurst, $2,665; Eleventh-st., Elmhurst, $1,877; Victor-place, Elmhurst, $1,265; Academy-st., Long Island, $1,917. Queens Borough Const. Co., Ninth and Tenth-sts., $4,586. F. Welch, Lawrence-st., $763.

New Orleans, La.—Contracts for constructing sixty-five mls. of sewers were awarded, Feb. 13, as follows: Irwin Bros., contract "L," $61,447; contract "M," $119,154.50; contract "O," $131,487; total, $311,977.50. A. L. Patterson & Co., contract "J," $63,306.50; contract "K," $95,-284.85; contract "N," $96,961.80; total, $280,-532.15. U. S. Cast Iron Pipe and Foundry Company, $73,465.25. These bids were received Feb. 2.

WATER-WORKS.

Decatur, Tex.—The water works system of this city has been sold to J. J. Perkins.

Los Angeles, Cal.—The Inglewood Domestic Water Company has been incorporated by Chas. Lloyd, H. L. Martin, L. R. Garrett, J. Cook, W. Rodman, B. P. Garrett of Los Angeles and Frank W. Phelps of Inglewood.

Arcade, N. Y.—The question of municipal water works will be voted on March 15.

Richmond, Ind.—The question of water main extension is being considered. Cy. Engr. Weber.

Puyallup, Wash.—The question of a municipal water plant is again being agitated.

Houghton, Mich.—The question of water works improvements will be taken up during March.

Oswego, N. Y.—Plans are being prepared for obtaining the city water supply from Lake Ontario.

Covington, O.—The construction of water works is contemplated. J. G. Wagner, secy. B. P. A.

Atlantic City, N. J.—In his annual message Mayor Stoy urges a reserve water supply and larger mains.

Fargo, N. D.—The question of purchasing a pump for the water works system will be voted on April 4.

Beaumont, Tex.—The purchase of two complete pumping plants is contemplated. W. A. Ward, secy. Orange Co. Irrigation Company.

Lesterville, S. D.—Bids will probably

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Kansas City, Mo.—Additional ordinances have been passed authorizing the laying of water mains and installation of fire hydrants.

Tiffin, O.—The citizens have asked council to employ an engineer to prepare plans and specifications for a new waterworks system.

Trenton, N. J.—The adoption of an ordinance providing for the installation of $100,000 worth of new water mains has been recommended.

Bridgeport, Conn.—The establishment of a filtration system is contemplated by the Bridgeport Hydraulic Co., of which Chas. P. Senior is supt.

Hartford, Conn.—The bd. of water comrs. contemplates building another reservoir on West Hartford shed, and enlarging the river pumping station.

Jamestown, N. Y.—Chief engineer Hancock thinks it would be advisable to replace the five boilers at the pumping station with new ones this summer.

Binghamton, N. Y.—John Anderson, supt., has been directed to prepare specifications and ask for bids for a new pumping engine of 12,000,000 gals. capacity.

Sackville, N. B., Canada.—(Special.)—Thomas R. Anderson, chmn. Water and Sewerage com. of coun. says this town contemplates the extension of the water works system.

Orange, N. J.—City engr. Crane has been directed to prepare plans for the construction of a new water main from the reservoir to this city.

Harrisburg, Pa.—(Special.)—M. B. Cowden, cy. engr. says that bids will probably be received within a month for a filtration plant. Address B. P. W., 26 S. Second-st.

Concord, Mass.—This town has asked the legislature for permission to issue $100,000 water bonds for the extension of the water works system. Wm. Wheeler, w. w. comr.

Perth Amboy, N. J.—A proposition has been made by New York capitalists to put in an independent water and electric light plant and sewer system for South Amboy.

Charlotte, N. C.—Preparations will begin at once for establishing a water works system west of this city on Irwin's Creek. A new pump, engines and boiler will be installed at once.

Oakland, Cal.—The bond committee has recommended that provision be made for an appropriation of $140,000 for the installation of water meters, in anticipation of the city's owning its water works system.

The question of issuing bonds for the construction of water works systems will be voted on as follows: Arcadia, Fla., Mar. 7; Brookside, Ala., Mar. 8; Alpena, Mich.; Millington, Mich.; Hawkeye, Ia.

Pittsfield, Mass.—A new supply reservoir to be built above the present distributing reservoir has been recommended by the bd. of pub. wks. The more general use of water meters is also recommended.

Tacoma, Wash.—The Mt. Tacoma Water Supply Company has asked council to appoint a committee to investigate its water with a view of entering into a contract with the company for furnishing this city with water.

Port Townsend, Wash.—The city council has recommended the passage of an ordinance calling for a special election to vote bonds for building a municipal water works system. The matter will be voted on Mar. 12.

Columbus, O.—The council com. on w. w. and finance has decided to recommend the adoption of a resolution to submit a proposition to issue $1,500,000 bonds for a water purification and softening plant to a vote of the people this spring.

Sherman, Tex.—(Special)—Charles E. Hayden, cy. engr., says that bids will probably be received March 7 for constructing a standpipe and extending the mains, plans for which are not yet complete. Some water works machinery is also to be purchased soon, but this is dependent on the water supply now being sought.

The construction of water works systems is contemplated at the following places: High Springs, Fla.; Salem, Ill.; Arion, Ia.; Glasgow, Mont.; Lyndon, Wash.; Bronson, Mich.; Kensington, Minn.; Louisa, Ky.; Seaside, Ore.; Milton, N. H.; Northfield, Vt.; Charlottesville, N. Y.; Millville, N. J.; Toccoa, Ga.; Ft. Gaines, Ga.; Vermillion, O.; Cedar Bluffs, Neb.; Granite, Okla.

CONTRACTS TO BE LET.

Key West Barracks, Fla.—Bids are asked until March 19 for installing a water main. Address Q. M.

Bardstown, Ky.—Bids are asked until March 8 for constructing a water works system. W. T. Eidson, cy. clk.

Belzoni, Miss.—Bids are asked until April 5 for constructing a water works system. S. Castleman, mayor.

Osceola, Ia.—Sealed bids are asked until March 8 for constructing a water works system. W. N. Temple, cy. clk.

Murray City, O.—Sealed bids are asked until March 15 for constructing a water works system. Harry Frazee, vil. clk.

Durant, Ind. T.—Sealed bids are asked until 8 p. m., March 2, for constructing a water works system and standpipe. W. L. Poole, mayor.

Ligonier, Ind.—Bids are asked until March 9 for rebuilding the water works and purchasing pumps and boilers. Mr. H. Jeanneret, cy. clk.

East Orange, N. J.—Sealed bids are asked until March 7 for constructing a reinforced concrete reservoir at South Orange. Stephen M. Long, cy. clk.

Atlantic City, N. J.—Sealed bids are asked until March 8 for laying 300 ft. of 12-in. submerged main. Louis Kuehnle, chmn. bd. water comrs.

Bremerton, Wash.—Bids are asked until March 26 for installing a water system at Puget Sound Navy Yard here. Mordecai T. Endicott, ch. bureau yards and docks.

Cambridge, O.—Bids are asked until

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March 2 for constructing extensions to the water works system, including pipe, hydrants, valves, etc. Chas. F. Blair, secy. B. P. S.

St. Paul, Minn.—Bids are asked until March 5 for constructing pump house and equipment, including pumps and boilers complete at Ft. Missoula, Mont. J. McE. Hyde, Q. M.

Detroit, Mich.—Sealed bids are asked until March 23 for constructing an intake crib, crib house, river shaft and 3,185 lin. ft. brick tunnel. Edward W. Pendleton, prest. bd. water comrs.

Frankfort, Ind.—Sealed bids will be asked until 12 m. March 15 for constructing and establishing a water works plant and supply of water to city for both public and private use. Otto Wolf, cy. clk.

Chickamauga Park, Ga.—Bids are asked until March 10 for constructing a pumping plant, including pump and boiler house, pumping machinery and connections to wells and reservoir at new military post here. Capt. H. W. French, Q. M., Chattanooga, Tenn.

Columbus, O. — Bids are asked until March 8 for furnishing a full and adequate supply of pure water to school buildings and school library by means of filters, drilled wells, boiled water, or any other method J. A. Williams, clk. bd. of education.

Lethbridge, Alberta, N. W. T.—Bids are asked until March 31 for work and machinery, including masonry foundation, pumping machinery, boilers, well, galleries and pump-house. C. B. Bowman, secy.-treas.; Willis Chipman, ch. engr., Toronto, Ont.

Cienfuegos, Cuba.—Sealed bids are asked until April 2 for furnishing 10,441 feet of of 24 to 4-inch c. i. pipe; 185 tons special castings; 279 24 to 4-inch valves; 130 hydrants; 345 tons structural steel; 11,135 sq. yds. expanded metal; 330,000 lbs lead. F. W. Bennett, ch. engr., San Carlos 128. C. C. Vermuele, New York City.

CONTRACTS AWARDED.

Milton, Ore.—The contract for remodeling the water works system was awarded to the Washington Pipe Foundry Company of Tacoma for $3,500.

Roosevelt, Okla. - (Special.)—Guy A. Parker, cy. clk., says that the contract for a tank and tower and laying two blocks of water mains has been awarded to E. S. Perkins & Co. of this city.

Auburn, N. Y.—The contract for furnishing 20,000 to 25,000 of 12-in. pipe has been awarded to the Warren Foundry and Machine Company of New York City at $22.60 a ton, and specials at 2½ cts. a lb.

Buffalo, N. Y.—The contract for new boilers, stokers, coal conveyors and other machinery for the water works pumping station have been awarded as follows: boilers and 9 engines, John W. Danforth, Buffalo, $10,760.

New Orleans, La.—The contract for furnishing pipe, specials, etc., was awarded to the United States Cast Iron Pipe and Foundry Company, New York City, as follows: For 2,600 tons straight pipe, $23.67 per ton; 42 tons of 20 and 36-in. flexible joint pipe, $65 per ton; 15 tons special castings, $65 per ton, and valves, $4,468; total bid, $73,465. The only other bid received was that of the Camden Iron works, Camden, N. J., which bid for straight pipe, 1,650 tons 48 and 36-in., $24.87; 660 tons 20, 18, 16 and 12-in., $25; 150 tons 6 and 4-in., $26.60, and for 42 tons 20 and 26-in. flexible joint pipe, $34 per ton; 15 tons special castings, $58 per ton; 60 tons special castings, $65, and for valves, $2,388; total bid, $75,516.

BRIDGES.

Angola, Ind.—Bids are asked until March 8 for three iron bridges. Bd. co. comrs.

Winchester, Ind.—Bids will be received until March 8 for building 16 new bridges.

South Bend, Ind.—Bids are asked until March 9 for building two iron bridges. John W. Harbon, co. audt.

St. Joseph, Mo.—Petitions for building eight steel bridges are being considered by the Pettis County Court.

Asbury Park, N. J.—Bids are to be asked for building a bridge at north side of Toms River at Main-st.

Scranton, Pa.—Bids are asked until March 12 for building several small county bridges. E. A. Jones, co. compt.

Boonville, Ind.—Bids are asked until 2 p. m., March 7, for constructing an iron bridge. R. D. O. Moore, co. audt.

Sacramento, Cal.—Bids are asked until March 7 for a trestle over water course ¼-mi. south of Walsh's Station.

Chicago, Ill.—Bids are asked until April 13 for a new bascule bridge over the Chicago river at Harrison-st. Drainage bd.

Versailles, Ind.—Bids are asked until 12 m. March 8 for constructing 2 wagon bridges and abutments for 2 wagon bridges. Nicholas Volz, co. audt.

Virginia City, Mont.—Bids are asked until March 11 for building a 2-span iron or steel flat truss bridge over Big Hole River. Bd. co. comrs.

Greensburg, Ind.—Bids are asked until March 7 for building an arch bridge over Clifty Creek. Separate bids will be received on stone or concrete bridge.

Butte, Neb.—Bids are asked until March 7 for building 5 combination steel bridges over Ponca Creek, and 1 over Kaya Paha River. D. A. Sinclair, co. clk.

Atlanta, Ga.—Capt, R. M. Clayton, cy.

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Battle Creek, Mich.—Council has adopted a resolution authorizing the cy. engr. to prepare plans and specifications for a bridge at McCamly-st. C. A. Jackson, Chmn. bridge com.

Atlanta, Ga.—Bids are asked until March 31 for building a bridge over Chattahoochee River between Fulton and Cobb Counties. H. E. W. Palmer, chmn. comrs. roads & revenue of Fulton County.

Cleveland, O. — Bids are asked until March 2 for constructing steel superstructure for bridge on Town line road between Brecksville and Royalton. Bd. co. comrs. William H. Evers Engrg. Co., engrs., 237 Arcade Bldg.

Salem, Ind.—Bids are asked until March 7 for building a steel bridge over Highland Creek at Quarry Ford, in Washington twp. Separate bids will also be received for stone work, fills, approaches and steel work. Frank E. Morris, co. audt.

Brookville, Ind.—Sealed bids are asked until 12 m. March 7 for reflooring two bridges and building a beam truss bridge and stone superstructure across Bull Fork at the crossing of the Clarksburg road, in Salt Creek twp. Charles A. Miller, co. audt.

Chicago, Ill. — City Engineer Spengler has asked the finance com. of Council for appropriations of $40,000 to begin work on the proposed bridge across the river at Archer-ave., and $50,000 with which to make plans and specifications for ten other bridges.

Belle Plaine, Minn.—Bids are asked for building stone piers or abutments of the Raven Stream bridge, town to furnish cement and sand. A. J. Irwin, town clk. Bids are also asked for constructing the steel work and material for wagon bridge on stone abutments. A. J. Irwin, town clk.

Indianapolis, Ind.—Sealed bids are asked until 10 a. m. March 14 for building a bridge on White River and Fall Creek road, Washington twp.; over Buck Creek, sec. 2, Perry twp.; over Buck Creek sec. 11, Perry twp.; over Buck Creek, bet. Perry and Franklin twps.; over Bean Creek, Center twp. John E. McGaughey, chmn. co. comrs.

STREET LIGHTING.

South Norridgewock, Me.—An electric light plant is proposed.

Logan, Utah.—This city voted to build a municipal electric light plant.

Sparta, Wis.—The question of building a municipal gas plant will be voted on.

Beloit, Wis.—Bids will be asked soon for plans for a municipal lighting plant.

Santa Cruz, Cal.—The construction of another electric light plant is proposed.

Neenah, Ill.—The business men are considering the construction of an electric light plant.

Valatie, N. Y.—The question of establishing a municipal lighting and pumping station will be voted on soon.

Newcastle, Pa.—Council has authorized the preparing of plans for a $65,000 municipal electric light plant.

Walnut, Ia.—Bids are asked until March 1 for an electric light and power plant. A. R. Longnecker, town clk.

Watseka, Ill.—Bids are asked until March 15 for an electric street lighting contract. C. L. Abell, cy. clk.

Omro, Wis.—The Omro Electric Light Co. has been incorporated by John Challoner, L. S. Lighton and S. Lighton.

Belzona, Miss.—Sealed bids are asked until April 5 for building an electric light plant. S. Castleman, mayor.

Columbia, Tenn.—Bids are desired for building and equipping an electric light plant. W. A. Dale, chmn. light committee.

Mt. Clemens, Mich.—The street lighting was awarded Feb. 15 to the Mt. Clemens Electric Co., for 5-yrs. at $58.12 per light per year.

Bay City, Mich.—The question of issuing $50,000 bonds for making additional city electric lighting plant will be voted on April 4.

Des Moines, Ia.—Sealed bids are asked until March 16 for an electric light system at Ft. Des Moines. Maj. R. B. Turner, Q. M.

Burlington, Ia.—Council has appointed a committee of four to investigate the feasibility of building a municipal electric light plant.

Newport News, Va.—A bill has been introduced authorizing this city to issue $100,000 bonds for the construction of an electric light plant.

Waycross, Ga.—Harding Johnson, a New York capitalist, and others have applied to the City Council for a franchise to establish a $100,000 gas plant.

Kemps Creek, Ala.—Plans and specifications for an electric light plant will be desired about March 15, by Frank F. Taylor, who secured a franchise here.

Benton Harbor, Mich.—The contract for 125 arc lights for five years was awarded to the Benton Harbor and St. Joseph Electric Light Company at $47 per light per year.

Baton Rouge, La.—An ordinance has been introduced authorizng the organization of a new electric light company. Prof. Henry Kretz and Edward Weick are interested.

Brooklyn, N. Y.—A resolution has been introduced asking for the appointment of a committee of five to investigate the question of establishing a municipal gas plant.

Lincoln, Neb.—The City Council has passed an ordinance to submit to the voters the question of issuing $65,000 bonds to erect a municipal electric light plant.

St. Paul, Minn.—The contract for an electric lighting system at Ft. D. A. Russell, Wyo., was awarded to the McBride-Downing Electric Company of this city for $23,965.

Aurora, Ind.—The contract for lighting this city was awarded Feb. 22 to the Sun Vapor Street Lighting Company of Canton, O., at $20 per lamp for 100 gasoline street lamps.

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Richmond, Va.—Sealed bids are asked until March 8 for installing a lighting and heating plant in the new cell buildings of the Virginia State Penitentiary. W. W. Baker, chmn. Pen. Bldg. Com.

The question of issuing bonds for construction of electric light plants has been favorably voted on at the following places: Jonesboro, Ga.; Mason City, Ia.; Sweetwater, Tenn.; Attalia, Ala.; New Haven, Ind.; Jackson, Miss.

Cleveland, O.—The American Lighting Company of Wilmington, Del., has been awarded the contract for lighting incandescent vapor lamps in this city for one year at $23.85 for each lamp now erected, $29.85 for each additional vapor lamp, $2.00 for each post set or reset.

The question of issuing bonds for the construction of electric light plants will be voted on at the following places: Hopkins, Mo., Cicero, Ind.; Penn Yan, N. Y.; Mooresville, N. C.; Ashland, O.; Monticello, Wis.; South Stillwater, Minn.; Lincoln, Neb.; Beaver, Utah; West End, Ala.; Ithaca, Mich.; Stoughton, Wis.; Thomasville, Ga.

Indianapolis, Ind.—The contract for public lighting for ten years was awarded Feb. 24 to the Indianapolis Light & Power Company at $75 a year for each light on both direct and alternating current enclosed arc lamps, and $74 on direct current open arc lamps; $35 a year on 50 c. p. incandescent lamps. Under the old contract this company received $85 a year for each light on a moonlight schedule. Other bidders were George E. Fisher of Detroit and Ernest C. Bruckman of New York City, who represented foreign capital.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Kalamazoo, Mich.—The Domestic Garbage Company has been incorporated.

Plainfield, N. J.—The question of municipal collection of garbage is being agitated. O. L. Jenkins, mayor.

Atlanta, Ga.—Bids are asked until Mach 25 for constructing a garbage plant. Address C. W. Strickler, 326 Empire bldg.

Oakland, Cal.—The garbage contract has been awarded to the Pacific Incinerating Company for a term of twenty years.

Harrisburg, Pa.—N. B. Cowden, cy. engr., says bids have been opened for garbage disposal, but contract has not yet been awarded.

Perth Amboy, N. J.—Sealed bids are asked until March 7 for the gathering and and other refuse for terms of 1, 5, 10 and 15 years. Frank E. Moores, mayor.

Dayton, O.—The Dayton Reduction Company has been incorporated by Charles Michael, W. C. Wuichet, George Wuichet, Walter Wuichet and William Chapman. The company has the contract for disposing of the city's garbage.

FIRE APPARATUS.

Houston, Tex.—Estimates of the cost of new fire alarm system are desired. Mayor Holt.

Trenton, N. J.—The purchase of three new steam fire engines, one new fire house and the installation of a fire company has been recommended to the common council.

Sackville, N. B., Canada.—(Special.)—Thomas R. Anderson, chmn. water and sewerage com. of coun., says this town contemplates establishing an electric fire alarm system, but has not yet decided what system to adopt. An inexpensive and efficient system is desired.

Knoxville, Tenn.—The purchase of one second-class fire engine, 5,000 feet of hose, two cellar pipes and the equipment of a hook and ladder truck is recommended. The rewiring of the fire alarm system and several additional fire alarm boxes are recommended in the report of Herman Schenk, city electrician.

SHREVEPORT, LA., SEWER CONSTRUCTION.

(1) Sealed proposals will be received at the office of the City Comptroller until 7 P. M., March 21, 1904, for constructing the following sewers:
736 feet of 18-inch vitrified pipe sewer.
690 feet of 24-inch vitrified pipe sewer.
279 feet of 30-inch circular sewer, brick or concrete.
363 feet of 42-inch circular sewer, brick or concrete.
373 feet of 54-inch circular sewer, brick or concrete.
40 feet of 72-inch circular sewer, brick or concrete with manholes, catch-basins and connections complete.

(2) Plans and specifications may be seen and blank proposals obtained at the office of the City Engineer.

(3) A certified check equal to 10 per cent. of estimated amount of contract, payable to the Comptroller of the city, must accompany each bid as a guarantee that if the bid is accepted a contract will be entered into. A bond equal to 50 per cent. of the amount of the contract will be required for the faithful completion of the work and as surety against all claims for material and labor.

The city reserves the right to reject any and all bids.

C. G. RIVES.
Comptroller.

NOTICE TO CONTRACTORS.

Notice is hereby given that the Common Council of the City of Frankfort will receive sealed bids, at the City Clerk's office of said city, up to 12 o'clock

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MUNICIPAL ENGINEERING

VOLUME XXVI APRIL, NINETEEN HUNDRED FOUR NUNBER FOUR

PORTLAND CEMENT MANUFACTURE.*

CLINKER GRINDING. GYPSUM.

By E. C. Eckel, U. S. Geological Survey, Washington. D. C.

Clinker Grinding—The power and machinery required for pulverizing the clinker at a Portland cement plant using the dry process of manufacture is very closely the same as that required for pulverizing the raw materials for the same output. This may seem, at first sight, improbable, for Portland cement clinker is much harder to grind than any possible combination of raw materials; but it must be recollected that for every barrel of cement produced about 600 pounds of raw materials must be pulverized, while only a scant 400 pounds of clinker will be treated and that the large crushers required for some raw materials can be dispensed with in crushing clinker. With this exception, the raw material side and the clinker side of a dry-process Portland cement plant are usually almost or exactly duplicates.

The difficulty and in consequence the expense of grinding clinker will depend in large part on the chemical composition of the clinker and on the temperature at which it has been burned. The difficulty of grinding, for example, increases with the percentage of lime carried by the clinker; and a clinker containing 64 per cent of lime will be very noticeably more resistant to pulverizing than one carrying 62 per cent of lime. So far as regards burning, it may be said in general that the more thoroughly burned the clinker, the more difficult it will be to grind, assuming that its chemical composition remains the same.

The tendency among engineers at present is to demand more finely ground cement. While this demand is doubtless justified by the results of comparative tests of finely and coarsely ground cements, it must be borne in mind that any increase in fineness of grinding means a decrease in the product per hour of the grinding mills employed; and a consequent increase in the cost of cement. At some point in the process, therefore, the gain in strength due to fineness of grinding will be counterbalanced by the increased cost of manufacturing the more finely ground product.

The increase in the required fineness has been gradual but steady, during recent years. Most specifications now require at least 90 per cent to pass a 100 mesh sieve; a number require 92 per cent; while a few important specifications require 95 per cent. Within a few years it is probable that almost all specifications will go as high as this.

Addition of Gypsum—The cement produced by the rotary kiln is invariably naturally so quick-setting as to require the addition of sulphate of lime. This substance when added in quantities up to 2½ or 3 per cent retards the rate of set of the cement proportionately, and appears to exert no injurious influence on the strength of the cement. In amounts over 3 per cent, however, its retarding influence seems to become at least doubtful, while a decided weakening of the cement is noticeable.

Sulphate of lime may be added in one of two forms: Either as crude gypsum or as burned plaster. Crude gypsum is a natural hydrous lime sulphate, containing about 80 per cent of lime sulphate and 20 per cent of water. When gypsum is calcined at temperatures not exceeding 400 degrees F., most of its contained water is driven off. The "plaster" remaining carries about 93 per cent of lime sulphate, with only 7 per cent of water.

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In Portland cement manufacture either gypsum or burned plaster may be used to retard the set of the cement. As a matter of fact, gypsum is the form almost universally employed in the United States. This is merely a question of cost. It is true that, to secure the same amount of retardation of set, it will be necessary to add a little more of gypsum than if burned plaster were used; but, on the other hand, gypsum is much cheaper than burned plaster.

The addition of the gypsum to the clinker is usually made before it has passed into the ball mill, komminuter or whatever mill is in use for preliminary grinding. Adding it at this point secures much more thorough mixing and pulverizing than if the mixture were made later in the process. At some of the few plants which use plaster instead of gypsum, the finely ground plaster is not added until the clinker has received its final grinding and is ready for storage or packing.

CONCRETE WORK IN CUBA AND YUCATAN.

By C. E. McDowell, Newark, N. J.

Concrete construction of buildings in tropical countries has existed for centuries, but took the form of adobe rather than the scientific processes of today. The native rock, as well as the sand used, was of a limestone nature. When put in one and two story buildings, erected and left undisturbed, they would last for centuries. We show in our sketches concrete work in Havana, Cuba, and street work in Merida, Yocatan. There is but one cement factory in Cuba. This is situated on the Almendares River, some five miles from Havana on the west. The cement is a Portland made from rock found at Regla, across the bay from Havana. American cements like the Atlas, Alpha, Lehigh, Vulcanite, Giant, Universal and other well-known brands, demand the trade for first-class work. The Cuban engineer and builder, clannish to a high degree, uses the Almendares brand to a large extent. Most of the improvements during the time of the United States army of intervention in Cuba were made with American cement. These represented a large expenditure of money and as great care was used in the construction, the work as a whole was very satisfactory.

The first view shows Campo Florida station, fifteen miles from Havana on the United Railway of Havana running to Matanzas. It is a sample of concrete stations proposed for this line and was built in 1900. The material, used in the pro-

is a very important one, being in the midst of a large dairy and agricultural district near Havana.

Venta Springs are said to be the greatest springs in the world, supplying as they do the City of Havana with 40,000,000 gallons of the purest water daily. They are ten miles south of Havana and reservoir and aqueduct lines to the city were most carefully guarded by the Spaniards during the last war. The source of supply consists of some 400 springs corraled in the reservoir, shown in the second view, and carried through a brick masonry oval-shaped aqueduct six miles long to the reservoir and gate house, shown in the third view. Meagre description as to the receiving reservoir at Venta Springs is to be had. It is a solid masonry and concrete basin some 150 feet square and 40 feet deep, faced with a sand-lime coating, which has stood secure since its completion in 1872, when it was connected by the aqueduct to the old city system. The records say that up to 1887 the work had cost $3,500,000.

The third sketch shows the Palatino reservoir and gate house. In 1889, thirty years after its inception, the new reservoir and gate house at Palatino, near Havana, was instituted by American engineers and pushed to completion in 1893, when the inauguration of the same took place by the Captain General of Cuba and Bishop of Havana. The reservoir and gate house are all of heavy masonry and

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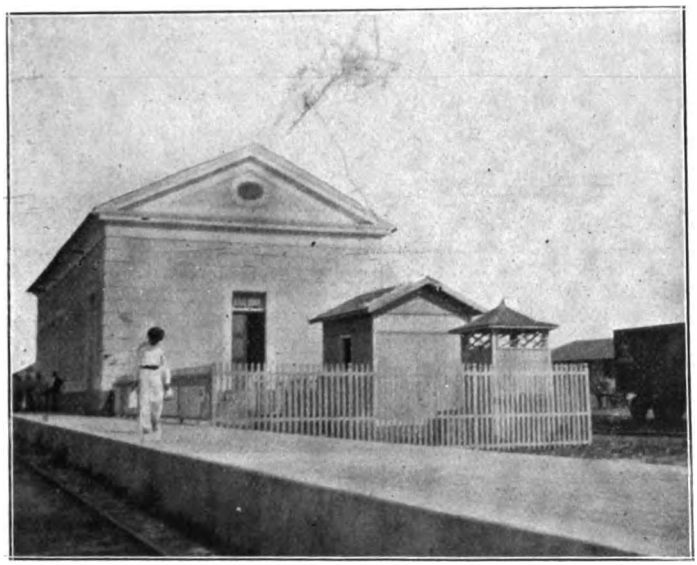
reservoir is one foot thick, laid in two courses of six inches each. This formed a volume of concrete, in all about 5,500 cubic yards, to be spread in so thin a sheet on so large an area, and great care was necessary in preparing the ground for its reception. The specified thickness was obligatory and on the other hand no extra thickness would be paid for.

The stone mostly used for this concrete was in every respect admirably adapted for the purpose, being an exceedingly hard crystalline limestone breaking readily in a crusher with a sharp conchoidal fracture. The sand was calcareous, there being no silicious sand procurable. It was sharp, very clean and gave excellent results. The keeping of the concrete thoroughly wet for long periods of time after being placed was inflexibly insisted upon. The precaution was doubly necessary in such a climate as that of Cuba and was enforced for all classes of masonry.

The inside faces of the reservoir walls were plastered with one part cement, one part sand and one part lime. It stood

The fourth sketch shows the top of the main tower of Mme. Rosalie de Abreux's concrete chateau at the Kina de Delicias on the Palatino road, some three miles from Havana. A fire destroyed her home in 1900 and so a contract was made with the Cuba Supply Company to erect a concrete building on the Ransome system to cost $100,000. The method of construction can be stated in a general way by saying that the walls inside and out, all floors and towers, are built under the Ransome system. The concrete used was very rich and consisted of the imported American cements, Alpha and Atlas; beach sand, (calcareous) from Bacharhanoa; and broken limestone from the Cuban Quarry Company's quarry at Jesus Del Monte near Havana. All of the concrete was kept thoroughly wet for thirty days while setting and so no cracks appeared. The main tower is 80 feet high with 12-inch walls at the base and 8 inches at top. The location is an ideal one, situated as it is on high ground in the midst of a beautiful tropical garden at the end of



I. CAMPO FLORIDA STATION, NEAR HAVANA, CUBA. CONCRETE.

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tan block from Canton, O. They are laid on a 5-inch concrete base made in proportion of 1, 3, 7, and finished with pitch joints. The stone used in the concrete is the native limestone, fairly hard and broken fine, ¼ inch to 1½ inches. The sand is calcareous in nature and comes from the beach at Progresso, 25 miles away. Giant cement was used in completing the mixture and the result was very satisfactory. In the sidewalks the same material was used, but in proportion of 1, 2, 5, and the top finished one to one, with a rough surface, and bound on the curb front with an iron face set in the concrete, under the Wainwright system. The sidewalks were laid in advance of the street work and are very irregular in width, covering as they do from the curb line to the fronts of the adobe houses, of which the whole city of Merida, Yucatan, is built. The effect of all this street work is to change the appearance of this 400-year-old city and to advance it along the line of civilization and progress a hundred years.

In all our sketches improved American cements have been largely used and the demands are constantly increasing. Modern American contruction is the ideal form for all of these southern countries. Some day a good native Portland cement rock will be found that will help construction work. In the meantime American engineers, architects and builders, are looking southward for business opportunities where brains and capital are needed to bring out first-class concrete construction work. The examples of work shown are evidence that the tendency is toward good work, equal to most of that in the United States.

WASTE UTILIZATION.

The title of this article suggests the treatment of municipal waste in such manner as to utilize the product of the process and thus save the valuable elements. An excellent system of reduction by cremation was described in the January number of Municipal Engineering, and some description of an English installation upon the same principle will be found elsewhere in this number. There are many reduction plants in this country which extract from the garbage all kinds of valuable products, and which seem to be operated at a good profit under the contracts of their owners with the respective municipalities.

There is in operation one system which is a combination of the cremation and reduction processes. Mr. F. G. Wiselogel, the inventor of the process, describes the plant and the method of operation in a paper from which the following abstract is taken:

By this system all material, dead animals, etc., is taken to the top floor of the plant, the hides are taken off the dead animals in a room especially prepared for this purpose and provided with a powerful fan to exhaust the air constantly, thus insuring an inward draft. The air from this room is blown into the boiler furnace and passed through the fire

draft to the tank as long as the door is left open. When the tank is full the door is closed and bolted and its contents cooked under vacuum. When sufficiently cooked the mass is allowed to settle and the grease is drawn off. This done, the tankage is subjected to a special treatment to extract the balance of the grease still mixed with it. The tankage is then dumped through a suitable pipe into the dryer below, without being exposed to the air or sight and is dried under vacuum with steam heat. When dry it is dropped into a conveyor, which conveys it to an elevator, which in turn delivers it into a revolving screen, from which the fine particles are spouted or conveyed into the shipping room, while the coarser parts that will pass through the coarse part of the screen fall into the mill to be ground to proper fineness, and are spouted into the conveyor, elevator and screen to land in the shipping room.

The large parts, bones, hoofs, tin cans, rags, etc., go out at the end of the screen as tailings and drop through a spout into a suitable bin.

The garbage, kitchen slops, butchers' offal, decayed vegetable or animal matter, etc., are hauled to the top floor and

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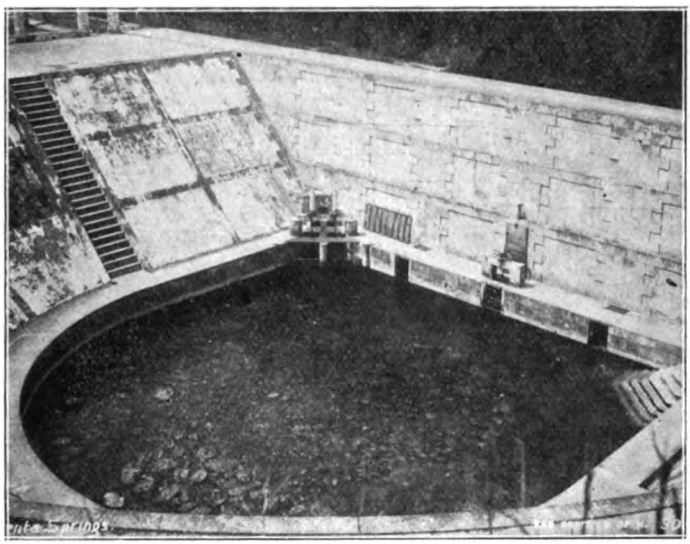
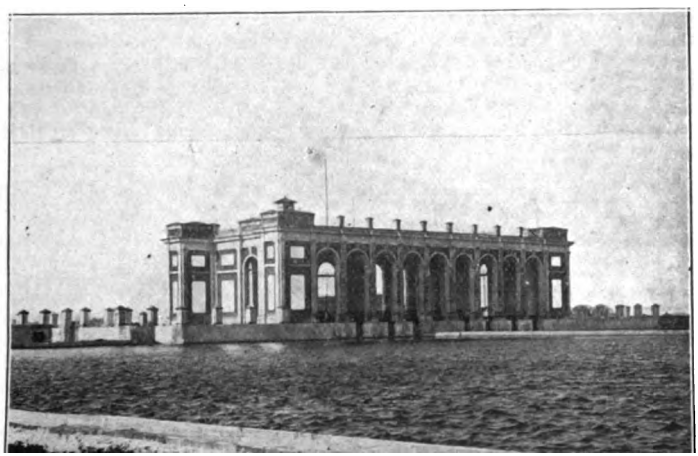


II. VENTA SPRINGS. HAVANA WATER SUPPLY. CONCRETE, BRICK AND SAND-LIME.



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all the vapors and gases emanating from the material in process of reduction and drying through proper condensers that condense all the vapors and pass the effluent through a sanitary filter bed into a cistern or sewer. The uncondensed foul air or gas is led in iron pipes into cast iron retorts walled in the boiler furnace and is there burned.

The dry waste, such as paper, paper boxes, rags, etc., is received in a room set apart for this purpose, where the different grades are separated and baled for shipment, while the other waste, such as floor sweepings, shavings, dry stable manure, yard cleanings, tree trimmings, wood, etc., is burned in a patented furnace attached to the boilers to help in generating the steam required to operate the plant.

The night soil, cesspool matter, wet manure and all kinds of foecal, animal or vegetable matter are taken to the top floor and thrown into the digester, then treated to a proper amount of acid to destroy any disease germs that may be in the mass, which is then dried under vacuum with steam heat at 350 degrees F. The digesters, like the tanks, are provided with air pumps, condensers and gas separators, connected with the filter bed and gas retorts in the boiler furnace.

The coal ashes are received on the top floor and thrown into hoppers connecting with suitable screens and separators. The ash goes into a suitable room to be mixed with cement and pressed into brick or used in plastering. The clinkers, mixed with cement, make excellent concrete, while unburnt coal or coke is used for fuel to make the steam to operate the plant.

All the floors, except the shipping room floor, are of concrete, pitched to a center drain. The inner sides of the walls and partitions are coated with an adamantine paint so there can be no absorption of bad odors. Plenty of water must be used to keep the floors, walls and apparatus thoroughly washed and clean to insure its sanitary condition at all times.

The products, such as grease, oil, hides, bones, tankage or fertilizer stock, paper stock, cement brick, clinkers, etc., find ready sale, while the unburnt coal, mixed with the other waste burned in the improved furnace, makes more steam than is required to operate the plant.

All material being received on the top floor, it flows by gravity to the bottom in the process of reduction and drying and lands in the shipping room an odorless and absolutely sterile product ready for the market. The apparatus, being powerful and especially designed for this business, makes the sorting of the garbage and consequent exposure in the plant unnecessary, as the tin cans, etc., are taken out by the machine automatically and dumped into the proper bin.

This is a concise description of the Wiselogel system of waste utilization, which is the result of nearly thirty years of study and experience in construction and operation of plants and many costly experiments. It has advanced by slow degrees and, owing to the first cost of former plants, it has been kept out of the general market except in large cities. Recent inventions and improvements have reduced the first cost of plant one-third and the cost of operation and reduction one-half, and it can be made profitable in small cities of 12,000 inhabitants as is shown by the latest plant of this system, the Star Tankage and Fertilizer Works of Vincennes, Ind.

ELECTROLYSIS NOT A NECESSITY.

By A. Ross Gray, Bradford, Pa.

The protection of water works distributing systems from destruction by electrolytic action has never received the careful attention which the importance of the question demands. In all our cities the water pipes are being damaged to a low at some future time if the trouble is not remedied, but in no case, I believe, has the engineer making such report offered any satisfactory method for the complete elimination of the trouble.

The theory is constantly advanced by

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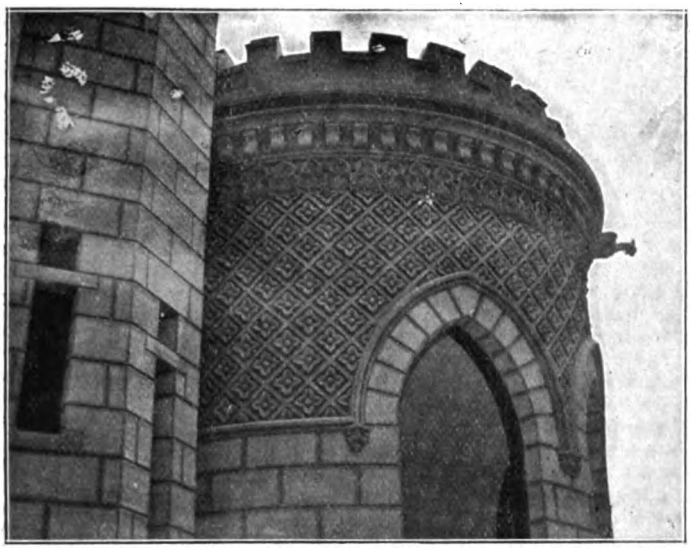
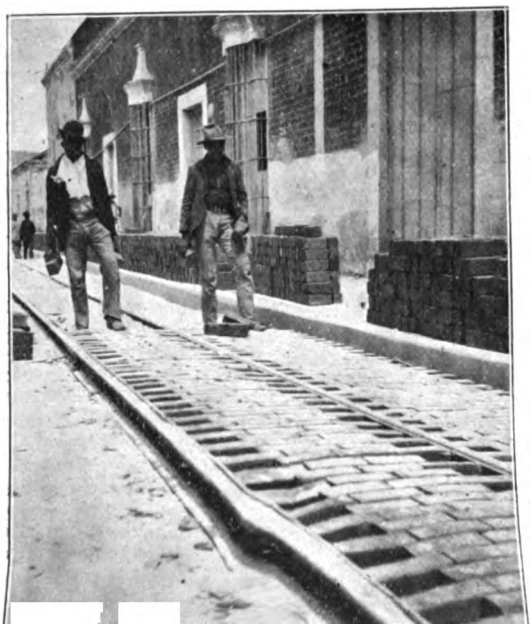


IV. TOWER OF MADAME ABREUX'S HOUSE, HAVANA. CONCRETE.



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agreed so generally upon this theory for two reasons principally: The first that the destruction of piping systems by electrolytic action is comparatively a new phenomenon, the protection of piping systems from it a new problem and one with which a large majority of the engineers are not familiar except in a theoretical way, having no occasion to make a careful study of the problem under actual conditions; the second, that the principal employers of engineers meeting these difficulties are the street railway and power companies. The piping system of any city offers a convenient return for the current of a street railway and as long as it remains a good return is the means of saving the railway company large amounts of money which otherwise would of necessity be invested in copper returns, and which copper if installed would not return the current as well as the piping system does. This is especially true in cases where the water department of a city has been led to believe that, if the piping system were connected to the track returns of the railway company or to the negative bus bar at the power station by a return feeder, all trouble from electrolysis would be at an end. Such connections are of great advantage to the railway company, because they reduce the resistance offered to the current by the ground between the pipes and the power station, and by reducing such resistance secure a larger flow of current on the pipes than could otherwise be obtained. Such connections are, however, the means of increasing the electrolytic action on the piping system a hundred fold.

It is maintained by many that the current is all taken from the pipes by means of such connection and that when this is the case no electrolytic action takes place. If the current were all taken from the pipes by such connections it is undoubtedly true that no action would result, but unfortunately the current is not all carried off by the connections. If the cross sectional area of iron in an entire piping system is calculated and compared with the cross sectional area of copper which is installed by the railway to take current from the pipe, making due allowance for the difference in the conductivity of the two metals, it will readily be seen that all of the current carried by the pipes cannot be taken off by copper returns as they are usually installed in such cases.

true, is it logical to suppose that the adoption of a plan whereby the amount of current flow is increased 100 per cent is the only means of protection which should be considered for a piping system? Does it not seem that such method of protection is a benefit to the street railway rather than to the piping system? Yet our water distributing systems are being daily connected by return feeders to tracks and to power stations. Does it look reasonable to expect to reduce the damage by increasing the cause of it? Yet this is the result of connecting pipes to a return feeder of any description.

Does it not seem reasonable to maintain that the only logical means to do away with the trouble is to eliminate the cause? In other words, deal with that which produces the trouble, instead of trying to deal with its effect? If it is true that the extent of electrolytic action is due to the amount of current flow, why not adopt a plan whereby this amount is decreased instead of increased? If such a plan is possible why do electrical engineers and the street railway companies not adopt it? Simply because for every ampere of current which is prevented from returning over a piping system the railway must invest in copper to supply a return of its own, and if the entire piping system of a city is so treated that it will not carry current the street railway company must invest thousands of dollars for copper to do the work which the piping systems are now doing. The use of return feeders has been tried times without number and the case is yet to be found where the electrolytic action has been lessened to any extent.

The almost universally accepted theory, which originated when we knew a great deal less about electrolysis than we do now, and which is being constantly harped upon by the railways today, viz: That electrolysis as affecting piping systems cannot be stopped and that the damage must go on, is a fallacy. Electrolytic action can be entirely eliminated in any underground piping system by the intelligent use of insulating joints placed at intervals in the pipes. The writer has had the supervision of the installation of insulating joints in numerous entire piping systems, containing from 25 to 300 miles of pipe, some of them in localities where the conditions were the worst that could be met. The result obtained in

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obtained are there to show for themselves.

If some radical change is not made by our cities in their method of dealing with this problem, during the next ten years will be noted the serious impairment of whole plants, necessitating the reconstruction of distributing systems at a cost many times greater than would be necessary to secure ample protection if applied before the damage becomes too serious.

It is of vital importance that piping systems in localities where street railways are operated should be thoroughly investigated to determine how severe the conditions are and that immediate steps be taken to secure adequate means of protection before the damage reaches a serious point. It is not safe to wait until the destruction that is going on becomes all too evident by the giving out of pipes during a critical time as that occasioned by a bad fire.

THE INDIANA STREET IMPROVEMENT LAW.

By C. A. Kenyon, Indianapolis, Ind.

The rapid growth of our towns and cities may be attributed to the progressive thought and restless energy of the American citizen. The progressive man wants to see his home town enjoy electric light, sewers, pavements, a police force, a fire department, during his lifetime. He is not content to say I will help build the sewers, and my children will help pave and their children will help pay for lights and fire protection. On the other hand there is a very active and noisy minority who do not want to pay taxes, do not want improvements.

The present constitution of the State of Indiana prohibits municipalities going into debt in excess of 2 per cent of the assessed valuation of the property within the municipality. This clause is a great restraint to the ambitions of the progressive class, and often is a distinct hindrance to the advance of a rapidly growing town or city. Again it has some advantages in that it will prevent public officials from indulging in ruthless extravagance. The 2 per cent limit is, however, so low that nearly every town and city in the State of any size is close to or beyond its legal limit of indebtedness, from sheer necessity.

Many people believe in and still advocate the old system of making public improvements, namely; pay for them out of funds raised by general taxation. Under our constitution, if this were the law there would be practically no improvements.

To meet the progressive idea the modern street improvement laws were devised, under which the cost of the improvements, sewers and pavements are paid for by the property benefited, in ten annual installments, represented by street improvement bonds, which bonds are not a part of the municipal indebtedness and hence not subject to the 2 per cent limit rule.

What is known as the Barrett Law was passed in 1889 by the Indiana Legislature, and under it the cities and towns of the State made such rapid progress that other States rapidly passed similar laws, with similar results. When the United States Supreme Court, a few years ago, decided the case of the village of Norwood against Baker, many lawyers thought it invalidated the Barrett law, and the Legislature of 1901 hastened to repeal it as to cities, by passing what is known as the Artman law, which was vastly inferior to the Barrett law in many vital respects, and it is to some of the defects of the Artman law that I desire to call attention.

1. An ideal street improvement law should be so simple and clear that an ordinary mind could understand it. The Artman law is so involved and complicated that no two lawyers construe it alike.

2. The property-owner whose land is to be taxed to pay for the improvement should have a right to be effectively heard, and if enough of his fellow owners should join in insisting that no improvement should be made then their protest should be effective, unless some urgent public demand or necessity for the improvement exists.

3. When it shall be decided to do the work, and its nature and character are determined, then all contests should be at an end. These applications should be carefully and accurately drawn, so that contractors may know exactly what they are bidding on and that when their work is completed they will surely get their pay without discount, delay, hold-up or quibble. There should be no chance at this time for the property-owner to con-

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test the matter except on one ground, to-wit., that the work was not done according to contract; and even this should be raised while the work is in progress.

If contractors know that they will get their pay as soon as the work is done according to contract in cash, or bonds that are at once as good as cash, they are in a position to offer very much lower prices, and competition will be sharper. On the other hand, if the contractor is filled with doubts as to when he will get his pay, as to whether he will ever get his pay, as to whether he can sell his street improvement bonds when he gets them or must sell at a ridiculously low price on account of some foolish provision that in no way benefits the property-owner, so that all his profit is gone, and a loss is entailed, the result is that the next time he bids much higher to provide for these things.

In my opinion the Artman law has about all of these defects. There is no serious objection to the advertisement and letting of the contract, although the property-owner could be given more rights. It is after the contractor has completed his work that his trouble begins.

The engineer measures up the work, finds it all right, computes the total amount due the contractor, and reports it to the Council; the law does not say when, but he usually does it in a reasonable time.

Then the Council can dally with the estimate as long as they see fit, without the contractor being able to help himself. I have frequently known it to be more than a month.

They then accept it, and refer it to the city commissioners, fixing a day for them to meet, and the city marshal notifies the city commissioners. They may take fifteen days to decide the names of the owners and the property that will be benefited by the improvement. (One day would be enough.)

They then report this to the Council, (what for no one has ever been able to definitely find out), who may let one or a dozen meetings elapse before acting on it, then only to report it back to the city commissioners, fixing a day and place for them to meet and notifying the property owners by advertisement that they may go before the commissioners on that day another day fixed they may have another hearing before the Council.

That hearing ended, the Council may take it under advisement indefinitely before confirming the assessment.

Finally they confirm the assessment, but after that any property owner who considers himself aggrieved may within twenty days appeal the whole matter to the Circuit court, where it may drag from three months to a year, the poor contractor out of his money and paying interest on his loans, being pressed by his banker, and no interest accruing on the amount due him.

Finally, if not entirely defeated on some technicality, the assessment is made, whether appealed from or not, and the assessment roll goes to the treasurer.

The property owners may at once pay in cash, which, by the way, few of them do. And then the Council must pass a bond ordinance. The lawyers do not agree as to how this should be drawn, and the contractor has to take his chances. At any rate after a time it is passed and bonds are issued and given to the contractor. Seldom does he get them within four months and frequently a year elapses from the time he finished his work according to contract. They are issued to him at par.

The city is through, but the contractor goes to his banker, who does not want them.

1. Because they only bear 5 per cent interest when he can keep his money loaned on short time paper at from 6 to 8 per cent.

2. One-tenth is payable each year and any property-owner may pay his entire assessment at any time without notice.

.3 If any property-owner on the entire improvement fails to pay his installment of interest or principal promptly each year as it falls due, the bondholder finds such coupons returned to him unpaid and he must go and look up the delinquent party and institute a foreclosure suit to get his money.

4. He must pay taxes on them while city bonds escape taxation.

The contractor finds he cannot sell them or if he does he must make the large discount the broker exacts.

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has cost the people in the short time it has been in operation hundreds of thousands of dollars, by reason of extra cost of work, and this is increasing.

Can anyone suggest the use of all those notices and references back and forth between the Council and the City Commissioners, with the numerous publications, all of which have to be paid for by the property-owners?

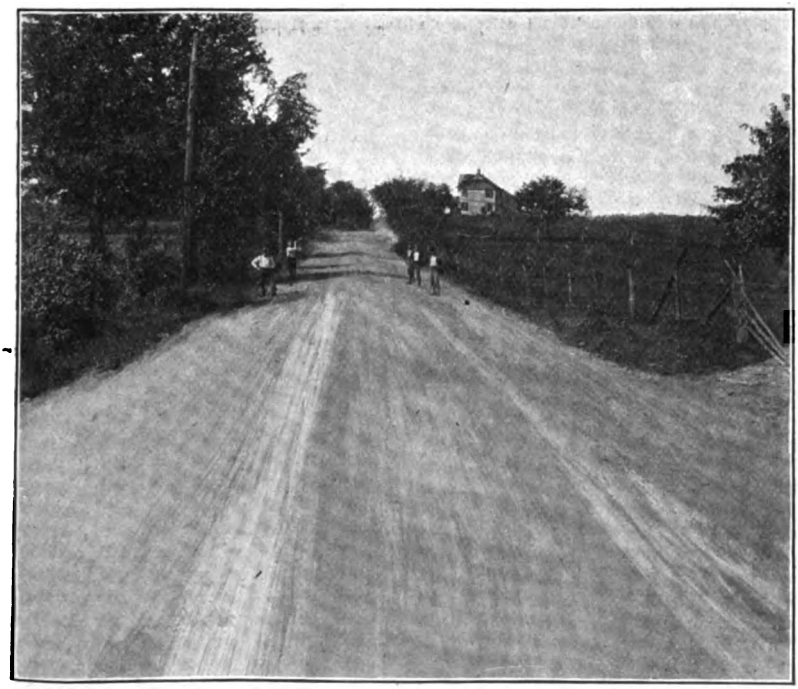
If a property-owner stands by and sees an improvement completed in front of his property, why should he afterwards be heard to say it is illegal, he will not pay for it, yet he will keep the improvement?

In no State in the Union have street improvement bonds, that only bear 5 per cent interest, such as are issued under the present law, been sold at par.

The option to pay the entire bond off at any time should also be abolished.

The law should specifically exempt these bonds from taxation. They are a greater burden on the taxpayer than general bonds. They are a tax, and to tax them again is a tax on a tax.

Everything that can be done to make these securities desirable should be done in the interest of the taxpayer. The more desirable these bonds are and the greater market there is for them, the lower the taxes for public improvements are. These bonds are in the nature of a statutory mortgage on real estate, and hence should be available as reserves required by law for insurance and surety companies.



A NEW JERSEY GOOD ROAD.

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EDITORIAL COMMENT

Methods of Garbage Disposal.

The Proposed Government Cement Plant.

Incompetence in Building Construction.

METHODS OF GARBAGE DISPOSAL.

The appearance in this and other numbers of Municipal Engineering of articles upon various methods of garbage disposal suggests a few words upon the advisability of a thorough study of all the methods in determining what method shall be used for a given place. In this country, at least, the disposal of garbage has not been considered as an engineering question, with the exception of a very few cases.

In a few instances the matter has been turned over to the health authorities with some success, but the tendency of that department is to consider the sanitary features to the exclusion of all others, so that it is possible to pass by meritorious processes from the sanitary point of view because they have other components which complicate the view of them.

In the great majority of cases, however, the matter is in the hands of a council committee or board, whose members do not claim to be expert either in sanitation or engineering, and who are only anxious to get through with a disagreeable matter as promptly and as cheaply as possible.

The consequence is that the ordinary garbage disposal plant is more or less of a failure. The process costs too much, the plant is too small, the delivery of garbage to it produces nuisance, the process is odorous, the product is valueless, the plant is not durable, it is not well located. The list of troubles can be indefinitely extended.

It is not to be expected that the ordinary city official shall be an expert in such matters as this. The fact is, there are very few experts upon the subject in the country. The technical nature of the that our readers may have a record on their desks for reference of the latest and best upon this important subject.

THE PROPOSED GOVERNMENT CEMENT PLANT.

The engineers who estimated the cost of the great Tonto basin dam for irrigation purposes near Globe, Arizona, added to the local price of cement at Globe the cost of hauling it by wagon to the site of the dam, and thus made the cost of the cement $9 a barrel on the work. Mr. E. Duryee, an expert cement manufacturer, now an engineer on the reclamation service, estimated the cost of a cement plant at the dam, where suitable materials for making cement are found. He estimated the cost of making cement in this plant at $2 a barrel, under the difficulties regarding fuel at that locality. The cost of making the 150,000 barrels or so of cement needed in the dam, including the total cost of the plant considered as scrap at the close of the work, would approximate $3 a barrel. This shows an apparent saving over the engineer's estimate of $6 a barrel, or, say $900,000. It was therefore decided that a cement plant should be erected for the purpose of making the cement needed in the dam, and the machinery has been purchased for the mill.

The cement companies, upon learning these facts, protested against the action of the government on two principal grounds, one that the government should not go into competition with private corporations in the manufacture of any needed commodity, and the other, that

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may not be necessary to consider it farther in this connection.

The second objection seems to have been well taken and was met by a call for bids from cement manufacturers, by which it developed that cement could be delivered at the dam at a cost of $4.81 a barrel, or $4.52 if the government did not retain the usual 20 per cent of the price until the completion and acceptance of the whole of the material. This reduces the estimated saving to about $1.80 a barrel, but this sum, amounting to $270,000 is well worth looking after.

Bids were received from very few companies. There are, in fact, very few companies near enough to compete, the two in Colorado and Southern California being the nearest and two others in the vicinity of San Francisco being the only other probable competitors.

Much capital has been made in some quarters of a claim that there is a cement trust which fixes the prices. The fact is, however, that there has been a cut-throat competition in the business, which has not been overcome, though it has been mitigated by recent conferences among the larger manufacturers. The companies have been put to it to do their best in reducing the price at the works and and in securing the best possible freight rates, so that the government's course has undoubtedly reduced the bid price a dollar or two below what it would have been had bids been called for in the beginning. From this point of view the purchase of the machinery has been fully justified even should it never be used.

The cement manufacturers propose a solution of the problem which seems on its face to be very satisfactory. Bids are to be received from the manufacturers to furnish cement on the work either from their own plants or from the government plant on the ground. The government may still hold itself in readiness to operate the plant if satisfactory bids are not obtained. The lowest bidder, if accepted, can then use the government plant with electric power from the government water power.

These bids will check Mr. Duryee's estimate of the cost of making cement, will increase the competition by extending the number of manufacturers who can reach the work, and, apparently, will give the government all the advantages of the ownership of the cement plant without the risk of depending upon the accuracy of the engineer's estimates of the cost of operating it. His estimate is more than double the usual cost of making cement by the dry process.

An important fact is emphasized by this discussion of prices, namely, the effect of freight rates in restricting competition and in fixing the price of cement. This is an exaggerated case, both because the long railroad haul and the wagon haul add a large amount to the factory price of the cement, and because the isolated condition of the work reduces the possibility of competition to a very small number of plants, say two, or at most, four.

The same factors enter into the fixing of rates in any case, but their effect is usually very successfully concealed. Under ordinary conditions of healthy competition, where plants are prosperous and do not need to cut below profitable factory prices, these factors operate first to restrict the competition to those factories where the cost of manufacture plus the freight charges are very nearly equal. Thus at A, cement from B, costing $1 to make and twenty cents for freight, will meet on equal ground cement from C, costing eighty cents to make and forty cents for freight. Any plant coming within this $1.20 limit has an equal chance.

The actual price of cement at A will depend upon many other items. If the demand is greater than the supply from these mills, the price will go up until a figure is reached at which plants with a higher cost but a smaller local demand can ship in their product. Thus the prices will fluctuate with the supply and demand in a healthy way.

If A happens to be so situated that two or three plants have a considerable advantage over any others, it is easy to arrange a combination which will raise the price nearly to that at which others can ship in profitably. If twenty or thirty is read for two or three and the combination extends to the restriction of production, we are as near a cement trust as we have ever attained in the American cement trade.

This illustration suggests one of the uses which may be made of the table of freight rates in the Directory of American Cement Industries. It could readily be carried much further if space permitted.

INCOMPETENCE IN BUILDING CONSTRUCTION.

A correspondent sends a list of failures of concrete construction in buildings which he says are used as examples of the inadequacy of this material for use in floors and walls and as fire-resisting protection for the supporting framework of

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steel skeleton buildings. Most of these cases of failure have been fully described in the public press, many of them in technical journals, and in every case which has been fully investigated it has been shown that there has been some incompetence or dishonesty in the design or construction, more than sufficient to account for the failure. In one instance, concrete beams were built which depended upon ordinary brick walls as anchors, and when the beams were loaded with but a part of the weight intended for them, their deflection, on account of insufficient area of cross-section and error in its design, pulled the walls of the building down. In other cases the thrust of the cement arches spread the beams or the walls sufficiently to permit the concrete to fall through. In other cases the proportions of materials, methods of mixture or methods of putting in place were so defective that the concrete developed only a small fraction of the strength which it might have if properly made. Partial loading or merely the removal of the centering caused collapse in these cases.

The Darlington building in New York is the most recent instance of the collapse of a steel frame for a building. The exact cause for this failure has not yet been determined definitely, but it is undoubtedly due either to defective design, overloading of the frame with structural materials on the way to their places, or defects in the construction. The sufficiency of the design is presumed to have been assured by the approval of the plans by the city's building inspector, so that, until the report of the official investigation is made, the building contractor will bear the greater part of the blame.

Whatever the cause, it is due to incompetency or dishonesty of some sort. The city's department is presumed to have done its duty when it guarantees the sufficiency of the plans, but in view of the serious calamities caused by the collapse of buildings during or immediately after construction, it seems to be the part of wisdom to extend the authority of the department over the supervision of the actual work of construction.

Some of the friends of concrete construction fear that the attacks made upon the failures in such construction will weaken the public confidence in the material for buildings. It may possibly delay the recognition of its value in some instances, but rabid attacks are always very largely their own refutation and the rapidly increasing number of excellent constructions in concrete will soon extend the knowledge of its successes and the reasons for its failures so that the latter will be less frequent and the former will be more numerous.

The failure of the Darlington building should not destroy the public confidence in the steel frame methods of construction. Neither should the occasional collapse of a badly designed or constructed concrete floor or brick wall condemn concrete or brick as building materials. The effect will rather be to enforce closer inspection of the processes of construction as well as of the designs upon which they are based.

Concrete, especially cinder concrete, offered an additional proof of its value as a building material by successfully withstanding the great heat of the Baltimore fire. In the words of one engineer on the ground, "Concrete appears to have stood the fire better than anything else."

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THE QUESTION DEPARTMENT

COST OF MAKING SLAG CEMENT.

Can you give me an idea of about the cost of a slag-cement plant of say 200 barrels per day, the class or makes of machinery required? We would like something like the Illinois Steel Company's north works plant on a smaller scale. Can you also give me data as to cost of producing slag cement in the barrel? D. D. G, Chicago.

If the slag is granulated at the blast furnace, where only it can be done properly, the only machinery necessary is that for drying the lime and the slag sand, a preliminary grinding of the latter, grinding the lime and slag sand together, elevators and conveyors, and packing machinery. The cost of this machinery will depend upon the kind of grinding machine selected. Griffin mills, made by the Bradley Pulverizer Company, tube mills such as those made by F. L. Smidth & Co. and the Bonnot Company, closed pebble mills or ball mills, and Kent mills are used in various plants, most of which make a preliminary reduction of the slag in one mill and the final grinding of the slag and lime in another. There are several dryers on the market. Reference may be made to the "Business Directory" under the headings "Dryers," "Cement Machinery," "Cement Plant Designers," "Tube Mills," etc., for names of manufacturers and dealers in cement machinery and experts in designing plants. They can give full information on cost when full details are known regarding materials and local conditions.

No definite figures are at hand regarding the actual cost of making slag cement. Estimates have been made varying from about forty cents up to sixty cents a barrel, the range showing the effect of local conditions and also the conservatism of the estimators.

MAKERS OF SAND AND CEMENT BRICK.

Can you give me the names and addresses of the different firms in the United States making sand and cement brick? W. J. M., Toronto, Ont.

The new edition of the "Directory of American Cement Industries" ($5), now nearly through the press, has a special list of the makers of stone and brick using cement and lime, in which will be found the names and addresses desired. Reference should also be made to the "Business Directory" elsewhere in this number under the heading "Cement Brick."

MAKERS OF ACETYLENE GAS MACHINES.

Will you please send us a list of the principal acetylene gas machine companies in the United States?

M. Marquette, Mich.

Hendricks's "Commercial Register" ($6) gives a list of about 150 makers and dealers in acetylene gas machines. Some of those in the vicinity of Michigan are the Abner Acetylene Gas Co., 36 LaSalle-st., Chicago, Ill.; Acetylene Apparatus Mfg. Co., 157 Michigan-ave., Chicago, Ill.; Alexander Furnace and Mfg. Co., Lansing, Mich.; American Acetylene Lighting Co., Battle Creek, Mich.; Briscoe Mfg. Co., 1427 Woodward-ave., Detroit,; Ransom Gas Machine Co., 372 E. Water-st., Milwaukee, Wis.

EFFECT OF FROST ON CEMENT POSTS.

We have commenced the manufacture of concrete fence posts at this place and and we would like to have your opinion as to whether frost would have any damaging effect where they enter the ground. We are making posts with five parts sand and gravel and one part Portland cement, mixed into a slush, and when the posts are about four days old we give them a dip into a solution of cement and water to close up the pores so as to make them non-absorptive. We have tried placing the posts in water and letting them freeze up solid and then have thawed them out, and to all appearance they were as good as they were before they were frozen.

GRIFFIN AND LOW,
Lake City, Iowa.

The amount of effect of frost upon concrete posts would depend upon the amount of water which could be absorbed by them. It is possible to make cement concrete which is practically waterproof, the proportion of cement to be used depending upon the amount of voids in the sand and gravel. This can be determined

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for the sand and gravel used by measuring the amount of water necessary to fill a box already containing a known amount of the sand and gravel. In practice a little more cement is used to allow for defects in mixing the concrete. The proportions named are about the minimum for close-grained concrete. It is quite probable that experiment would show the advisability of using a little more cement.

Posts set in wet ground would need to be more impervious than those in well-drained soil.

If well done the process of dipping the post should aid somewhat in making its surface impervious, but it should not be depended upon as a complete correction for errors in mixing the concrete.

Concrete of the proportions named is less porous than many kinds of stone, and it would be less affected by frost than any but the densest and strongest stone. The tensile strength of concrete is greater than that of stone and the action of frost in bursting the post would have much greater resistance than it would have in a stone post similarly situated. Alternations in freezing and thawing posts porous enough to absorb an appreciable amount of water will result in a sort of granulation of the surface and the separation of these grains rather than in the spalling which often happens to stone under the same conditions. The life of a concrete post, well made except as to porosity, is therefore likely to be much longer than that of most stone under the same conditions. It is not difficult to reduce the porosity to a very small proportion with corresponding advantage. Whether the added life is sufficient to compensate for the greater cost will depend upon the amount of the excess of cost. The whole matter is a refinement which needs but little consideration in practice.

INFORMATION ABOUT CONCRETE BUILDING BLOCKS.

Does your monthly magazine tell all about concrete building block making and the machine? We will use the cheapest and best method of building concrete walls, cornices, floors, sills and steps for cottages we can get hold of; a plan that can be used without skilled labor. We can get sand, gravel, fuel and limestone on the land and common labor at $1 a

cement block machines. Since the development of this method of construction began, but little more than two years ago, this magazine has given everything of importance on the subject. The list of articles is too long to reproduce here, for nearly every number contains articles on the blocks and their use and the machines for making them.

CONTENTS OF A BAG OF CEMENT.

One local dealer will put out only three sacks of Lehigh cement to the barrel and other cements are delivered four sacks to the barrel, so I will be under obligations to you if you will kindly tell me how many sacks constitute one barrel of Lehigh cement.

J. W. BURNEY, Bainbridge, Ga.

The dealer referred to is apparently in error. The Lehigh Portland Cement Company conforms to the usual custom of putting 95 pounds net of cement in a sack, which is four sacks to a barrel. He is possibly confusing Portland with natural cement, the latter being delivered in paper sacks of about the same weight, but only three to the barrel, since natural cement weighs less than Portland.

SPECIFICATIONS FOR CONCRETE PIERS.

Will you please inform me where I can get specifications for concrete abutments and piers for railroad work. Or refer me to a book on railroading containing such specifications.

A. W. FISHBAUGH,
Celina, O.

The "Hand-Book for Cement Users" ($3) gives the specifications desired.

CONCRETE BASE FOR FENCE.

We are about to construct a fence 600 feet long, the base of which will be made of concrete blocks 7 feet long by about 18 inches square, with the upper edges beveled.

Any information which you can give us regarding the best way to proceed to do this work will be appreciated.

M. & C., Philadelphia, Pa.

The laying of concrete blocks is a simple operation. The foundation being properly prepared (a very essential matter), the molds can be staked or braced in place, filled with the concrete mixture,

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CRACKS IN CEMENT BLOCK WALL.

I have a building constructed of hollow cement blocks, placed on a frost-proof foundation. The wall is cracked half-way up the building and it was not caused by a blow or anything of that sort. The foundation did not crack or settle and the cracks referred to were in the blocks only. What was the reason?

D. Z., Hanover, Ont.

This can hardly be answered without an inspection of the building. As the question reads, the crack is due to some movement of the wall. Are the blocks cracked or does the crack in the wall follow the joints between the blocks? In either case settlement of the wall, expansion or contraction, or bulging of the wall by frost or some other force, which may be slight and soon disappear, might account for it. Further information is necessary to determine whether the fault is in the design or the construction of the wall.

PRICE OF CEMENT FOR SIDEWALK PURPOSES.

Please give me the prices on cement for sidewalk purposes. There will be some sidewalks put down here this year.

F. R., Fayette, Iowa.

Some recent bids run from $1.29 to $1.55 a barrel for cement in sacks on cars at the mill, to which freight must be added. The table of freight rates in the "Hand Book for Cement Users" ($3) and in the "Directory of American Cement Industries" ($5) give much help in determining the additional cost due to shipping charges.

CONCRETE WALK WITH NATURAL CEMENT IN BASE AND PORTLAND CEMENT IN TOP.

We note a very interesting discussion in your last issue regarding the adhesion of a natural cement base with a Portland cement top. We think your explanation is very good and covers the subject carefully. We, however, would like to add, as perhaps of some benefit to the party making the inquiry, that the specific gravity of a true Portland cement is at all times over 3, thereby being the heaviest hydraulic material known to the trade. It therefore forms [illegible] water is added to Portland cement a chemical change takes place. In theory, all of the water up to 20 per cent is crystalized and this will take place with or without air. Portland cement will set under water or in a vacuum and all of its characteristics are so entirely different from a natural cement that they cannot in anywise be classed together.

These facts, together with the difference in contraction and expansion, we believe will explain why a Portland cement and a natural cement should not be used together.

HOUSTON BROTHERS CO.
Pittsburg, Pa.,

The writer does not agree with all the statements regarding the chemical action of natural cements stated above, but does agree with the proposition that the differences in the chemical actions are usually such that the two cements cannot be used safely in the combination under discussion.

TO WHICH STREET DOES THE INTERSECTION OF TWO STREETS BELONG?

Will you kindly inform me as to the solution of the following problem? Thirteenth street, running north and south, crosses South street (44 feet wide), which is paved east of the easternmost line of Thirteenth street. North of South street, Thirteenth street is 60 feet wide. South of South street it is 40 feet wide and its eastern line is opposite the western line of Thirteenth street north of South street, i. e., there is an offset in Thirteenth street equal to its width north of South street. An ordinance proposes to pave Thirteenth street from its north end "to the south line of South street." Is the part of this description in the intersection a part of Thirteenth street or is it a part of South street, and should any part of its cost be assessed on the block on the southeast corner of the intersection?

J. A. WILSON, Lexington, Mo.

This is a problem for attorneys versed in Missouri law to wrestle with. The council has evidently described this intersection as belonging to Thirteenth street. The end of the improvement abuts on 60 feet of the north side of the block on the southeast corner and in most States this would authorize an assessment upon this

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sons would probably agree that the intersections in this particular case belong to South street, but in law the definition of the ordinance or custom may govern. The most equitable form of assessment should be chosen by the engineer and the modifications necessary to make this conform with the statutes may be left to the legal advisers of the city.

INSPECTION OF BRICK PAVING.

A correspondent states that he proposed the method of inspection of a completed brick pavement outlined in Municipal Engineering, vol. xxv, p. 425, and was met with the objection from the contractor that no engineer has done this; that it is unheard of, unfair, etc. On the other hand the taxpayers observe that the pavement has a very uneven, undulating surface and will not be satisfied until the work is fully inspected and made right.

In too many instances pavements are laid, especially in the smaller cities, without inspection by any competent city authority, or with so little, owing to the multiplicity of the city engineer's duties, that it practically amounts to nothing. The nature of the contract will govern the force of the inspection, but well-made contracts usually contain a provision that the discovery of defects at any time will lead to reconstruction of the defective sections, even though passed by an inspector. This is a salutary provision which is no hardship on an honest contractor, for the courts will protect him against any injustice which may be forced upon him, but will uphold the authorities in demanding reconstruction of work passed by incompetent or dishonest inspectors.

In case there is no inspection during construction, it is difficult to see how the condition of a brick pavement can be determined without cutting into it. Even the areas which show up well on the surface may be defective underneath and in worse condition than the areas which show greater defects to the eye. Such an inspection by an unprejudiced person can have no terrors for the contractor who manner described in the article referred to, the points for examination being selected by the taxpayers who had appointed themselves as inspectors. Fortunately for the contractor, these cuts showed his substantial compliance with the terms of the contract.

Undoubtedly our readers can cite similar instances from their own practice and we will publish the results if they are sent in, with or without reference to names and places as may be preferred.

SLAG PAVING BLOCKS.

Will you kindly advise me whether paving blocks are being made from blast furnace slag in this country at the present time and, further, whether blocks of this character make entirely satisfactory pavements?

R. L. H., Philadelphia, Pa.

Slag is used for paving purposes and is furnished by the Vulcanite Paving Co. of Philadelphia, Pa. So far as the writer knows there is no use of slag paving blocks in this country on a commercial scale. Can our readers give any information on the subject?

LAYING LARGE WATER MAINS.

Norfolk is about to install a 30-inch water main, five miles long, to supersede one of smaller bore. The council resolution providing for the main restricts the bidding upon it to local contractors and plumbers.

This restriction has aroused much criticism. It is objected that no local contractor is equipped with the machinery necessary for handling such large pipe; that none has had any experience in caulking pipe of this size, and that unless the city, therefore, modifies its resolution, it is likely to pay two profits for the work.

It is said on the other side that local contractors can easily buy what apparatus they need for the work, and some declare that no special appliances are demanded for it.

Kindly tell us what special facilities, if any, are required for laying and caulking pipe of this size in the most effective way and under the cheapest and most favorable circumstances.

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such contractors there may be several. The smaller the number of possible bidders, the greater the possibility of a combination of bidders and an increase in price. If the work is somewhat unusual and but few, if any, have had any experience in it, this possibility is still further increased, for those who have not had experience may feel some hesitancy in taking risks with it and will increase their bids to cover the risk due to their lack of knowledge, or, as in some instances, when there are one or two bidders whose experience will enable them to bid low enough to insure the contract going to them, may bring about a combination which will put them on an equality.

Criticisms similar to this are easily made, and the bids, when received, may or may not show that they are well founded. Bids can almost always be rejected if too high.

In this particular case it may be said that the 30-inch pipe can be laid without any very special appliances. Heavier derricks will be necessary to handle it successfully, and there are special appliances for supplying lead and running it into the joints, as well as for caulking which materially aid in the work and consequently reduce its cost. These appliances can probably be rented if the work is not extensive enough to warrant their purchase and contractors desire to avail themselves of them.

A restriction of bidders to local contractors is not very common in the larger cities and if it is made on ordinary contracts it is likely to be omitted when competition would be too greatly restricted. Whether such a restriction is advisable in this case is a local question which cannot be answered without full knowledge of all facts.

BINDING FOR MUNICIPAL ENGINEERING.

What would be your price for binding Municipal Engineering?

CARL MAUGHMER,
City Engineer, Nampa, Idaho.

The Simplex binder can be obtained at this office of proper size for Municipal Engineering for 50 cents, each binder sufficient for one volume of six numbers. To the first order for binders should be added 30 cents for a stapler and a box of steel staples which are used in attaching the number to the back. Volumes will be bound for subscribers for $1.50 each, in half morocco, six numbers in a volume, the loose numbers being sent for the purpose. New bound volumes, including the six numbers and the binding, are sold for $2.50.

MAKERS OF SMALL TANKS.

Will you kindly give us the names of some of the manufacturers of small tanks made up in either copper or galvanized iron or both? The principal sizes will be such as are used by doctors, for instance, as supply tanks, with average pressure of 40 lbs. per square inch. Other sizes would range up to about 10 cubic feet capacity, with correspondingly higher pressures; for instance, tanks to be used in connection with gas engine starters.

F. W. S., Indianapolis.

William B. Scaife & Sons' Co., 221 First-ave., Pittsburg, Pa., can doubtless supply the tanks desired.

The Pressed Steel Tank Co., Milwaukee, Wis.; Ironclad Mfg. Co., New York City; Holthoff Machinery Co., Cudahy, Wis.; Randolph-Clowes Co., Waterbury, Conn., are other makers of copper or galvanized iron tanks and boilers who may be able to meet the requirements.

LIGHTEST GRADIENT FOR PIPE SEWER.

What, in your opinion, is the lightest gradient that should be used for an eight or nine inch vitrified pipe sewer, that is, in extreme cases.

SUBSCRIBER, ——, Mont.

Some discussion of this question will be found in Municipal Engineering, vol. xxii, p. 382. It requires a fall of one foot in 250 in an eight-inch pipe or of one foot in 300 in a nine-inch pipe to produce a velocity of two feet a second, running full or half-full, assumed to be a self-cleaning velocity, according to Kutter's formula. Latham's tables give one in 400 and one 450 as the gradients producing this velocity. If the sewer does not run half full the velocity will be less. If it is necessary to run the sewer on flatter grade or, as is ordinarily the case, it does not run half full, special means must be taken to keep the sewer clean. It is possible to run a sewer on a level line, but to keep it clean one must run water through it under pressure at intervals or must run cleaning tools through it. The gradients named are ordinarily given as the minima, but are not always possible, and when they are not, flush-tanks, flushing manholes, water pipe connections, or special appliances for cleaning must be supplied and used freely.

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HOW TO LAY CEMENT WALKS AND FLOORS.

Mr. G. S. Neff of Rochester, N. Y., refers to the article in this department in the number of Municipal Engineering for December, 1903, vol. xxv, p. 419, on specifications for laying cement sidewalks, and makes some criticisms of it.

He objects to the digging of a trench 15 to 18 inches in depth to be filled with cinders or other porous material on the ground that this trench will fill with water which will freeze and throw the walk out of shape. This would be true were the trench dug in an impervious soil and proper provision for drainage were not made. The porous cinder, gravel or broken stone foundation is intended to remove any accumulations of water as far from the walk as possible and to leave the moisture in this foundation as much room to expand in freezing as possible so that it will not lift the walk. Were it possible to make a foundation which would at all times be impervious to water, it would be ideal. The soil cannot expand from freezing if there is no water to crystallize. But since few, if any, contractors have ever been able to obtain such a continuously impervious foundation, the next best thing is to have one so porous and so deep and so well drained that there shall be no accumulations of water enough to fill it full and with so much vacant space well distributed through it that any moisture clinging to the solid particles may have ample space in which to expand in freezing without crowding these particles out of place. Mr. Neff says:

Now, why not lay your walk on the earth as you find it and see to it that the water along your walk can drain off and also cut your flags well through at the joints so that they can give when the flags begin to heave and you will have less broken flags and also less settlement when the frost gets out of the ground. The article also gives the quantity of cement, sand, gravel and stone; viz., 1 to 3 to 5, making one part of cement to eight parts of sand and stone, which will make 45 square feet of finished walk. Now, at 1 to 8 cement and broken stone will make at least 60 square feet of walk; 1 to 5 will make 50 square feet of walk with 3 inches of 1 to 5 and one inch of 1 to

The article also gives formula for laying cellar and basement floor, in which it states that 1 part of cement to 5 parts of sand and 10 parts of gravel or broken stone gives good results. Whew! That may do to look at, but not to use. That's like giving a Clydesdale horse a cupful of oats for a meal. You may think it sufficient for the horse, but it is only a question of time when the horse will die from overfeeding. To sum it up, you cannot expect to do good work and durable unless you use enough cement, and that good cement.

Now my way of building a walk is as follows: I never use a shovel full of ashes, cinders or clinkers. If I have to fill and get earth I use sand. I place my stringers; make my concrete 5 to 1 and the top 2 to 1, the concrete just moist enough to ball well in the hand; fill the frame level full; then pound down one inch. When I wish to make or cut my joints I place a 2x4 cross piece, of which I have three. I make my flags five feet square. I place a cross piece at every five-foot mark on the outside of the stringer and fill up at least five or six, remove the 2x4 crosspieces and fill the joints with sifted concrete and ram down well. When I have the five or six squares and the joints filled in, I proceed to put on the top. If the weather is warm and the occasion demands it, I sprinkle water on the concrete before putting on the top. I strike it with a straight edge, then let it set for a few minutes or until the surface will bear floating, then finish with trowel and as I go along cut the joints through the sifted concrete, top and all, open up the cut with the jointer and finish with trowel.

This laying every other flag one day and then the spaces between the next is a back number. I never use paper. By cutting as above you will have just enough space for expansion and you will have no double joints, but you must pound the joints well.

I have given guarantees for six years and in no instance have I been called upon to make good.

I have made one flag 13 feet long, four feet wide, all in one piece, four inches thick; also two flags seven by eight feet, four inches thick. They have been laid eight years.

All that is necessary is to see that the water can run off, not under the walk. Then your flags will raise even and will settle down again when the frost leaves.

BOOKS ON CONCRETE WORK.

Will you kindly inform me what

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crete" ($3), It is one of the older books, but is excellent, and when it is brought down to date by additional study of the "Hand-Book for Cement Users" ($3) will be found a valuable guide. Many things about concrete can only be learned by experience.

A new book, Gillette's "Earthwork and Its Cost," is the most complete book on this subject. Experience may not bear out all its statements, but on the whole it is a good treatment of the subject.

INDEX TO MUNICIPAL ENGINEERING.

In response to the request for expressions of desire for a printed index to the back volumes of Municipal Engineering, made in the March number, a few additional subscriptions have been received. Are there others who will purchase the index if it is printed? If enough advance promises are made the index will be published.

WEATHERING OF CONCRETE BLOCKS.

For something more than a year we have been manufacturing stone from cement and sand. The bulding stone put out by us has so far proven satisfactory. We have foundations which are now standing the second winter and the stone is apparently better and harder than when put into the wall. We do not use cement enough to fill all the voids in the sand, and our stone readily absorbs water. We have taken our stone and placed it under a hydrant and let it stand constant dripping, and in winter, freezing and thawing, with no apparent effect upon it, and the stone so used absorbs water freely. We have in the face of pretty general disapproval of our product by stone masons, made very encouraging progress in its introduction. Still the stonemasons insist that in the course of two or three years the stone will very perceptibly show signs of disintegration and say they have read that is the course of stone of this nature, and some say they have seen it. So far we have never been able to get anyone to point out a specific instance. The writer has just recently completed a new house in which he used the regular stone from our plant in the foundation, and without any misgivings as to the outcome. Can you give us some information as to the experience of those who have used stone of the kind usually made in the plants scattered over the country? We have made stones of various proportions, and all the way from 3 per cent of sand to 1 per cent of cement to 30 per cent of sand to 1 per cent of cement, but the stone we place on the market is uniformly 8 to 1. The other stones were for experimental purposes. The 30 to 1 rubs off easily, but seems to stand the effect of freezing and thawing as well as any and shows remarkable strength.

P., ——, Kan.

Reference should be made to the answer in another place to the question about the freezing of cement posts. One finds many small stone spalls at the foot of walls made of some classes of stone, which are apparently separated from the stone faces by frost, chemical action or the action of heat and cold in expanding and contracting the outer surfaces. The same spalls are not found at the foot of a concrete wall, partly because the concrete is not in so pronounced layers as the stone and partly because it has a much greater tensile strength and its surface is not so easily broken by the action of frost or temperature changes. The poorer mixtures of concrete may ultimately act as the 30 to 1 mixture referred to, so that the outer surfaces will rub off, and in that case fine dust or sand will be found at the base of a wall left undisturbed for some time. The richer mixtures do not have this difficulty and any mixture which makes a hard, homogeneous, smooth surface, such as 8 to 1 and stronger mixtures can be made to have, will not show this action, if one may judge by comparison with similar but not identical samples of concrete construction. Mixtures even weaker than 8 to 1 are often entirely satisfactory from this point of view.

The records on this subject are very meager and our readers are invited to add to them. We will publish all that may be sent to us for that purpose.

ADDRESSES OF CEMENT COMPANIES.

Will you kindly send us the addresses of the following cement manufacturers: Dexter, Phoenix, Reading, Vulcanite.

F. P. R., Johnstown, Pa.

From the "Directory of American Cement Industries" ($5) these addresses can be ascertained with full information regarding the products of their works, the offices and agents, brands manufactured, etc. The addresses are as follows:

Dexter Portland Cement Co., Nazareth, Pa.; Samuel H. French & Co., sole agents, York-ave., Fourth and Callowhill-sts., Philadelphia, Pa.

Phoenix Cement Co., Nazareth, Pa.; William G. Hartranft Cement Co., Sole selling agents Philadelphia, Pa.

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Reading Cement Co., Reading, Pa.

Vulcanite Portland Cement Co., offices Philadelphia, Pa.; works, Vulcanite (postoffice Phillipsburg), N. J.

WOOD FIBER MACHINE MAKERS.

I am in the market for a wood fiber and wood pulp machine and thought you could possibly inform me where to get the best one in the market.

W. B. T., PLASTERER,
Charleroi, Pa.

Hendricks's "Commercial Register" ($6) gives the following names of makers of fiber machinery: Joseph C. Todd, 203 Broadway, New York; J. W. Voglesong, Elyria, O.; Wood Fiber Machinery Co., Sandusky, O. Wood pulp grinders can be obtained of several manufactures, the nearest one to the inquirer being Pusey & Jones Co., Wilmington, Del. Wood pulp knives are sold by Coes, Loring & Co., Worcester, Mass.

ACETYLENE GAS REFUSE IN SEWER.

We have several persons in town using acetylene gas plants. These people wish to run the wash and slaked carbide into the sewer. Can you furnish any information as to whether same will settle or fill up the pipes. B. B. M., ——, Me.

Can our readers give any results of observation? The character of the refuse seems to be that of finely divided rather light materials and it would seem that it would give no more trouble than other fine material, such as fine sand or clay. Is there a tendency to harden in mass if left undisturbed?

MUNICIPAL MATTERS IN COURT

Higher Courts—Gardner Water Plant—Liability of Water Company for Fire Loss—Classification of Bids—Reasonable Rates—Northern Pacific Merger.

Abstracts of Decisions of the Higher Courts on Matters Relating to Municipalities.

Prepared by Russell T. Byers, LL. B., Indianapolis, Ind.

Assessments—Avoidance Because Debt Limit is Exceeded—The owner of property knowing of a street improvement and acting under the advice of an attorney, made no objection until the improvement had been assessed. He is not entitled to have such assessment set aside, the assessment being equitable and fair, on the ground that the company, a foreign corporation, doing the work had not complied with the laws of the State relating to foreign corporations or for the reason that the contract was void because the of the cost of such improvement, even though notice is served upon him as sole owner, and is not served upon the other owners. City of Louisiana vs. McAllister, 78 S. W. Rep (Mo.) 314.

Assessment — Confirmation — Collateral Attack—It is too late to urge the failure to make an itemized estimate of the cost of an improvement a part of the record as a defense to an application for judgment for delinquent assessments. This objection should have been urged to the confirmation of the assessment. The general rule is that no objection (save lack of jurisdiction and that must appear on the record itself), which could have been made to the confirmation of the assessment will be heard when suit is brought for the delinquent assessments. The fact

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Improvements — Abutting Owners — Where the expense of constructing improvements is met by abutting property owners, they are parties so interested as entitles them to insist that all proceedings should conform to law. Under the statutes, where the board of public works declares the sidewalk of a property owner living on a non-graded street defective, such property owner is entitled to ten days' notice before the city will be justified in letting a contract for the improvement.—City of Waukesha vs. Randles et al. 98 N. W. Rep. (Wis.) 237.

Improvements — Contracts — Validity—Though the specification of a contract for public improvements contains a so-called alien labor clause, since declared invalid, it is competent to show that this item was not made a part of the contract, thus increasing the cost of the improvement. Where the contract contained such an invalid clause, which was disregarded by all parties, the contract was not void in toto as against public policy.—Doyle et al. vs. People ex rel. Hanberg. 69 N. E. Rep. (Ill.) 639.

Improvements—Sufficiency of Notice—Meaning of Repairs—Under the statute providing for the publication of a proposed ordinance for a street improvement, the fifth consecutive day may fall on Sunday and be included in the computation of time. Held, certain improvements were not repairs under Sec. 5,681, which provides that the cost of all repairs shall be paid out of the general revenue fund.—Barber Asphalt Paving Co. v. Muchenberger et al., 78 S. W. Rep. (Mo.), 280.

Ordinance — Resolution — Certainty — Under the statutes the description provided for in the resolution of the Board of Public Improvements need not be so detailed as that provided for in the ordinance authorizing the improvement. Description held sufficient.—Gage vs. City of Chicago, 69 N. E. R. (Ill.), 588.

School Property Assessment. — The State constitution and code do not exempt lots donated by Congress, title to which is in Board of Education, from taxation for local improvements. Such an expenditure is for the benefit of schools. Such lots may not be sold to enforce collection of assessments, but this is no objection to the levying of the assessment, nor does the fact that said lots are occupied and unused exempt them from such taxation. City of Chicago vs. City of Chicago, 69 N. E. Rep. (Ill.), 580.

Sidewalks — Advertisement — Right of Lien.—Under proceedings provided for in the statutes a sidewalk was constructed in front of the real estate in question. The advertisement for bids referred for the specifications to a particular ordinance which did not provide for this particular improvement. Held, no lien attached. City of Louisiana vs. Shaffner, 78 S. W. Rep. (Mo.), 287.

Special Assessments — Equalization—A finding that the property is "specially benefited and shall be assessed for the full cost of construction of said sewers according to their foot frontage" is equivalent to finding that the benefits are equal and uniform and is not subject to collateral attack.John V. Connell et al. 98 N. W. Rep. (Neb.) 457.

Street Improvements—Remonstrance—Effect of Withdrawing Same—Under the law when a remonstrance, signed by a majority of the abutting property-owners, is filed, remonstrating against a given improvement, the jurisdiction of the council is ousted and it can not be reconfirmed by a portion of the remonstrants withdrawing their objections. City of Sedalia vs. Scott, 78 S. W. Rep. (Mo.), 276.

Water Rentals—Taxing Power—The statutes limit cities, with a population of less than 5,000, to a seven mill taxation for hydrant rentals. This is a limitation on the taxing power, and such cities will not be permitted to levy an additional tax to pay a judgment secured in an action to recover unpaid rentals in excess of such limit. State, ex rel. Young vs. Royse. Mayor et al. 98 N. W. Rep. (Neb), 449.

Water Supply—Where a civil district having no authority to contract for water for fire protection enters into such a contract the district is not liable on the contract.—South Covington vs. Kenton Water Company, 78 S. W. Rep. (Ky.), 420.

Gardner, Mass., Must Pay for Water Plant.

The decision of the Supreme Court of Massachusetts in the appeal of the town of Gardner, Mass., against the decision of the special water commission, makes it obligatory for the town to pay the Gardner Water Company $274,000 and interest at 6 per cent. from July 1, 1902. The only point in the commission's decision to which objection was made was the award of $90,000 for water rights in Crystal lake. The town contended that the water rights in the lake could not be considered as an asset that should be paid for.

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Water Company Not Liable for Fire Loss.

The Supreme Court of California has rendered a decision which involves the question of whether a water company is liable for the value of town property destroyed by fire, where at the time of the fire the supply of water was deficient. A fire occurred at Ukiah, and through a breakdown of the pumping plant of the Ukiah Water Company there was no water in the town hydrants at the time. The fire destroyed much property belonging to individuals, and also a portion of the city hall and a lot of fire apparatus belonging to the town. The town sued the water company for damages, and a jury gave a verdict in favor of the city for the value of the property destroyed by the fire. The Supreme Court holds that a water company under the laws of the State of California does not by its charter undertake to pay for property destroyed by fire, although it may be negligent in supplying water at the time, and that neither a municipality nor an individual whose property is destroyed by fire has any right of action against a water company for damages.

Classification of Bids for Pumps Upheld by Court.

Justice Fort of the New Jersey Supreme Court handed down a decision March 3 in the case of the Marine Engine & Machine Co. of New York against the city of East Orange. The Marine Engine & Machine Co. filed an application for a writ of certiorari, claiming that it was the lowest bidder for pumps and engines to be erected at White Oak Ridge for the new water supply of East Orange. It cited that the contract for the work was awarded to the Snow Company for $48,050, which was about $10,000 higher than its bid. The contract was awarded for two 4,000,000-gallon pumps and three large boilers. The company held that the bids were classified as A., B. and C., and that on advice of the city counsel, Philemon Woodruff, the Common Council rejected the bids in class A. and C. and accepted the lowest bid in class B., that of the Snow Company. It was claimed in the application that the pumps and boilers of the Marine Company were just as good as those of the Snow Company, be-class A. than in class B. Also, that the engines of class B. were more durable and ran slower than those of class C., thus lasting longer.

In his decision Justice Fort decided in favor of the city on the ground that it had awarded the bid to the lowest bidder in class B. and rejected all bids in classes A. and C., and that all formalities had been observed. On the authority of four cases in the Supreme Court, no fraud having been charged against the East Orange officials, the court stated that it would not interfere with the exercise of discretion vested by the law in the city officers.

The decision upholds the principle that bids can be obtained in classes and that a municipality is not compelled to award the contract to the lowest of all the bids, but only to the lowest in any one set, rejecting all others.

Reasonable Water Rates Must Be Adopted.

In compliance with a decision of the United States Supreme Court, Justice Morrow of San Francisco dismissed March 2, without prejudice, the bill of complaint in the suit of the San Joaquin and Kings River Canal and Irrigation Company against the county of Stanislaus, awarding costs to the defendants. The Supreme Court's decision was as follows:

That hereafter, in case the counties of Merced and Fresno shall fix rates in such a manner that, taken as a whole, the rates in the three counties of Stanislaus, Merced and Fresno would not insure an income of at least 6 per cent, the complainant would not be bound to accept such rates, and this court would not bind it in regard to the propriety of rates for the future.

The Northern Pacific Merger Decision.

Justice Harlan of the United States Supreme Court handed down a decision, March 14, in the merger of the Northern Pacific and the Great Northern Railroad Companies. The decision, which affirms the opinion of the Circuit Court for the district of Minnesota, is in favor of the government and the effect is to sustain the contention that the Sherman anti-

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dissolving the merger of the two roads, which the United States claimed had been created by the creation of a holding company, the Securities Company. This consolidation was claimed to be in violation of the Sherman anti-trust law. It was claimed on the behalf of the government that this consolidation was in effect a pool, created to promote the interests, not of one system at the expense of the other, but of both at the expense of the public. The railroads claimed that the transfer of the stock of the two companies to the Securities Company was in the nature of a sale and perfectly legitimate. Justice Harlan said that in the merger of the two roads the stockholders disappeared and reappeared in the Securities Company, the two thus becoming practically consolidated in a holding company, the principal object being to prevent competition. He said:

"No scheme or device could certainly more effectively come within the prohibition of the anti-trust law, and it is within the meaning of the act a trust."

In reviewing the contentions of the Securities Company, Justice Harlan quoted the various opinions involving the trust question, saying that from them it is to be gathered that all contracts in restraint of trade, reasonable or unreasonable, are prohibited by the Sherman law, and that Congress has the power to establish such regulations as are laid down in that law. Congress had power to enact the statute. Replying in detail to the points made for the Securities Company, Justice Harlan adds that the contention that the law is an interference with the rights of the individual States by which the companies are incorporated was not well founded. In such cases, he said, the authority of Congress is supreme. He also declared it to be unnecessary to determine the right of owners of railroad stock to sell their property nor was it true that the right of the Securities Company to own and hold railroad stock is the only question involved. Such contentions are wide of the mark—mere men of straw. All that the government complains of is the existence of a corporation to repress commerce, and is not concerned with the other points.

Justice Harlan said that in this day there should be no doubt of the complete power of Congress to control interstate commerce, all appropriate means might be resorted to for that purpose. All the prior trust cases were in support of that contention. Whether free and unrestrained competition was wise, he said, was an economic question with which the court need not concern itself, the question was that of statutory law.

He asserted the power of Congress over interstate commerce to be as complete as the power of a state over domestic commerce.

Coming to the plea of the railroads that the anti-trust law should be declared unconstitutional, he said that the court could not see its way to that end. "If the Securities Company's contentions are sound why may not all the railroads of the United States enter into a combination and by the device of a holding corporation control rates throughout the country in defiance of Congress?"

Continuing he said that there had been nothing in the securities company's certificate of incorporation to indicate its purpose to be that of destroying commerce, and he therefore absolved the State of New Jersey from any charge of such knowledge in advance. It might be true that a Federal Court has no power to dissolve a corporation of a State, but this circumstance could not be an indication of powerlessness to enforce the law, than which no corporation is stronger. No device could suffice to prevent this enforcement of the national statutes.

The courts had in deed consistently held to the supremacy of the national laws in case of conflict between those laws and the laws of the States. So long as Congress confined itself to its prescribed functions, he said, there could be no danger. At any rate the error, if any, was with Congress and it was for Congress to supply the remedy, and not for the courts.

In his judgment the evidence fully sustains the material allegations of the bill and shows a violation of the act of Congress, in so far as it declares illegal every combination or conspiracy in restraint of commerce among the several States and with foreign nations, and forbids attempts to monopolize such commerce.

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ELECTRIC LIGHT

Improvements in Electric Arc Street Lighting.*

By H. W. Hillman, Schenectady, N. Y.

During the past few years, the manufacturers of electric street lighting material, and the electric lighting companies in general, have devoted much thought one of the best lighted streets in the world. Either day or night, it is representative of the best practice which the advancement of the art permits. The New York Edison Company owns the poles and lamps; also furnishes current for lighting. The policy of this company has been to install orna-

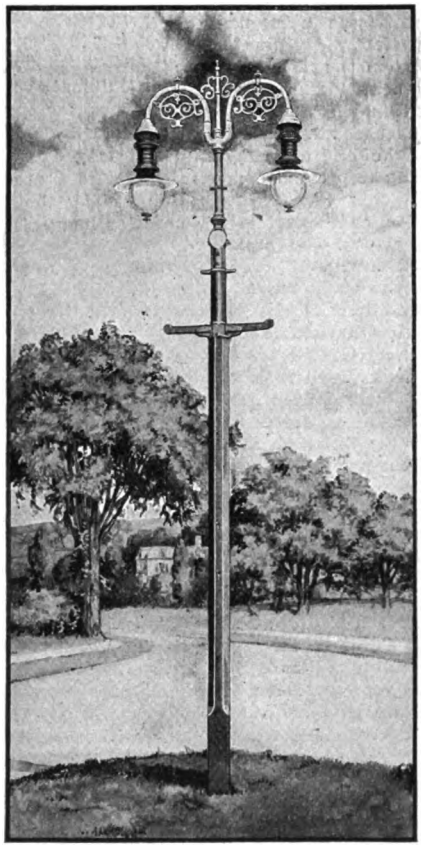

FIG. 1—ORNAMENTAL POLE, BOSTON, MASS.

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time, it represents a municipal improvement in connection with which the New York Edison Company deserves much credit.

Those acquainted with New York City will remember the "Isle of Safety." How easy it would have been to arrange the arc lighting system so as to thwart the artist's design of beauty. On the contrary, it is entirely a work of art, completed by the engineering skill of the New York Edison Company. Incidentally

FIG. 2—OLD STYLE HOOD AND CUT-OUT.

it was necessary to turn the lamp upside down and equip it with a new and latest design of mechanism; but the grand point of the entire scheme was when the artist and the engineer came together and, with one accord, effected that design, which will stand for all time as a monument in honor of municipal improvements.

Not desiring to dwell at length on New York City lighting, I do wish to call your attention to another illustration of the determined desire on the part of the electrical industry to advance electric street illumination only as it harmonizes with the attractive and ornamental appearance of other street requirements. Where the lamps are installed on bridges a careful inspection will show some of the prettiest designs of ornamental poles, especially considered in connection with the trimmings on the bridge, and particularly designed as a part of the bridge. In this installation I claim the utmost degree of engineering skill in behalf of municipal improvements.

The city of Boston has been highly favored in respect to ornamental electric arc street lighting. Everywhere throughout the city and suburbs of Boston will be found the so-called "Boston Ornamental Poles." Upward of 7,000 electric arcs illuminate this city, each and every arc being suspended on an ornamental pole. The Boston Edison Illuminating Company has made itself world famous by the installation of the electric inclosed arc street lighting system. It was not an easy problem for them to change their several thousand arc lamps and install a system entirely different from that which had been so extensively adopted and approved during the previous years. Notwithstanding, their efforts met with grand success, and this association can well afford to follow me in my endeavors to present the many features of this inclosed arc system which represent municipal improvements of a high order. (See Fig. 1.)

There are 8,760 hours during the year. Allowing 3,700 hours for darkness, there remain approximately 5,000 hours of daylight, when arc lamps and poles are on exhibition before the citizens of our communities. Fig. 2 shows an old-style hood and cut-out. The new style ornamental

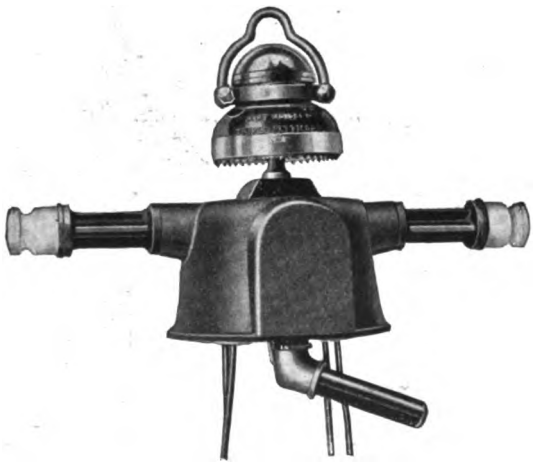

FIG. 3—MODERN CUT-OUT.

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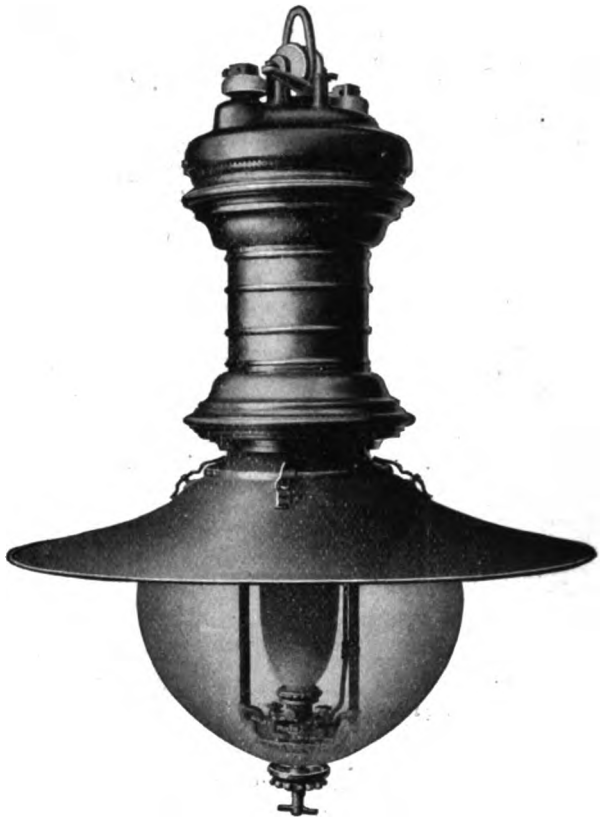

FIG. 4—ENCLOSED ARC LAMP WITH REFLECTOR.

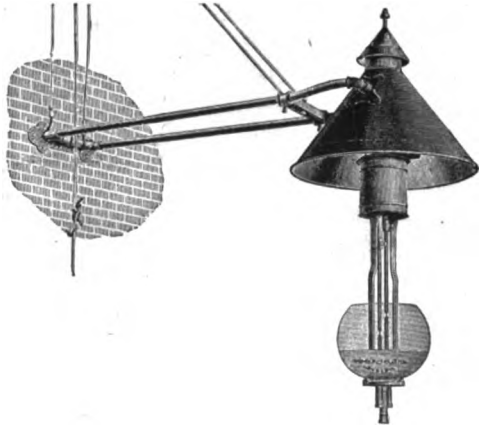

FIG. 5—OLD STYLE OPEN ARC LAMP WITH HOOD.

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pole is equipped with a cut-out concealed within the pole, and the lamp is made weatherproof, so as to require no hood protection. When ornamental poles are not available. Fig. 3 illustrates a modern cut-out of ornamental design.

The new system includes a very attractive light reflector, its under surface being finished in white enamel. This will not rust or be subject to injury from the elements. It will therefore retain a white glossy appearance, with frequent attention from the attendant trimming the lamp. Its shape is symmetrical and in

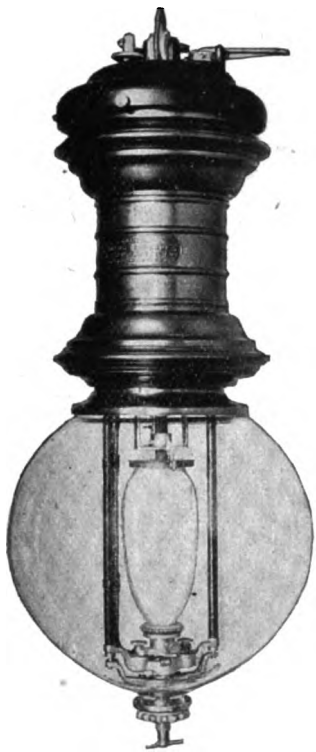

FIG. 6—ENCLOSED ARC LAMP.

harmony with the size of the lamp. (Fig. 4.)

The globes of the new system offer a marked improvement over the old style. Fig. 5 shows an exterior construction of the lamp, the globe being open at the top. Ample opportunity was afforded for the wind to blow the arc, and occasionally chunks of carbon would drop down into the globe. Dust and dirt accumulated there, which could not be easily brushed out. As a result, the globes easily became dirty and presented a bad appearance.

Fig. 6 illustrates a new enclosed lamp. Its inner globe prevents the carbon from dropping into the outer globe. The lamp casing rests snugly against the outer globe, and at all times insures a clean appearance.

Fig. 7 shows you an up-to-date washroom for cleaning globes. Each week the inner globes on the new lamps are changed and clean ones substituted.

Fig 8 shows one of the new carriages of the Buffalo General Electric Company, which is used for trimming the lamps, carrying carbons, inner and outer globes, etc.

It gives me much pleasure to illustrate this carriage, as it suggests a strong argument in favor of municipal improvements. In past years, the old style lamps required trimming each day, and it was not uncommon to see an old express wagon stop across the electric car tracks, holding up fifty or one hundred merchants on their way to business in the street cars, while the arc lamp was being lowered, trimmed and raised again into place. Municipal improvements are surely favored today, when a rubber-tired buggy of attractive design is driven to a lamp once a week and the lamp does not have to be raised and lowered in the street for trimming.

In a recent conversation with an electric lighting manager in the Pennsylvania territory, he stated that it was as much as a trimmer's position was worth to leave a broken globe on a lamp more than twenty-four hours. Surely such systematic efforts are co-operative with your own advanced ideas on municipal improvements.

Modern ideas regarding ornamental features have not injured the operating end of the arc lighting business.

On the contrary there never was a time in the history of arc lighting when the regulation was as good as it is today.

Fig. 9 shows a chart of the current variation on an enclosed arc street system, which is nearly a straight line without any variation. As a result, the 3,700 hours of darkness during the year are protected by a system so steady in operation as to have been commented upon by the most prominent electrical engineers of the country. The distribution of light has been improved, and the new system is the result of a new patented device known as the Street Luminometer. (See Fig. 10.) This instrument is considered to be a very valuable device. It is an easy and excellent method of proving to city authorities the comparative value of light distribution of the old and new systems.

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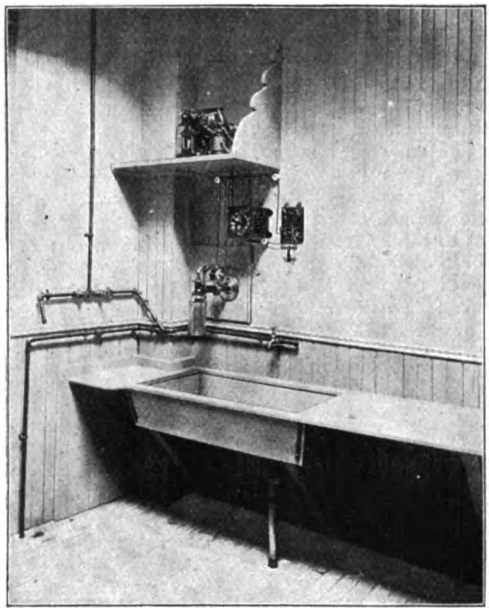
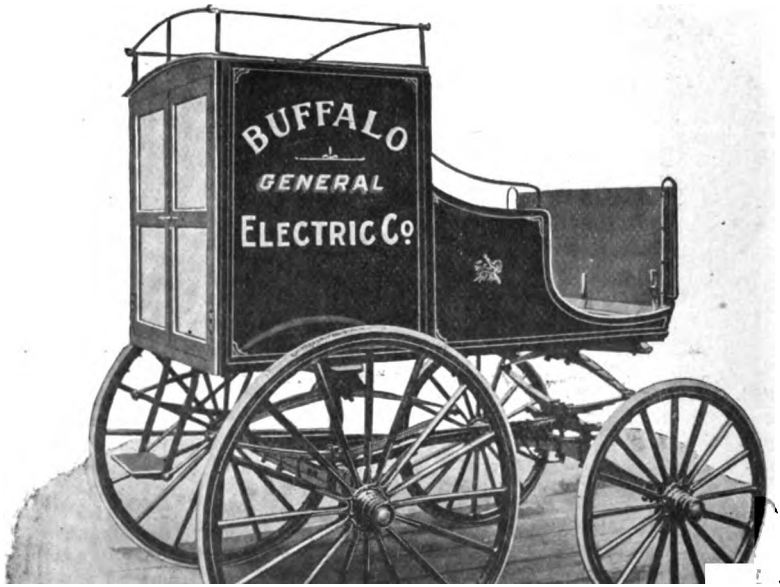


FIG. 7—WASH ROOM FOR GLOBE CLEANING.



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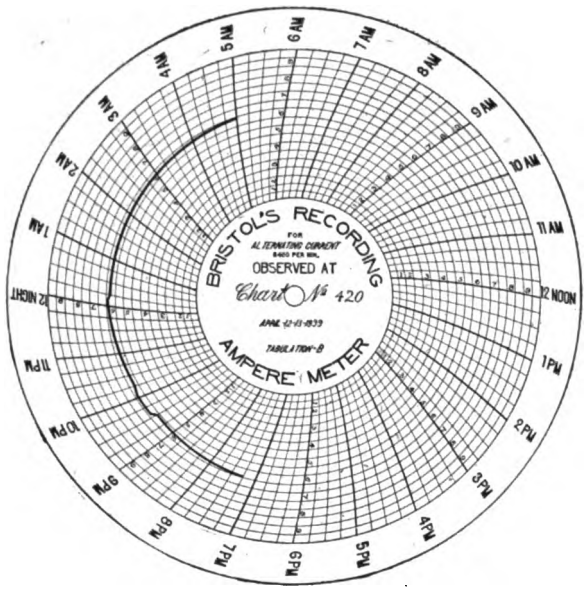
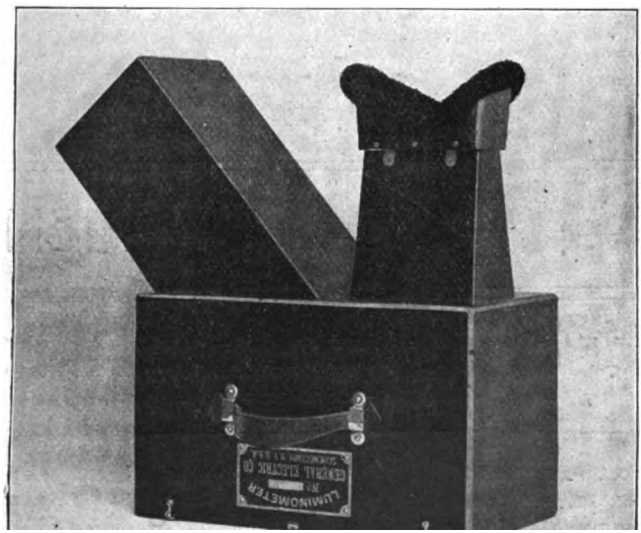


FIG. 9—RECORD CHART SHOWING REGULATION OF CONSTANT-CURRENT TRANSFORMER.



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The engineering improvements in hangers and cut-offs have minimized the danger of handling arc lighting circuits. This is a point which can be appreciated by everybody, regardless of the degree of technical education with which one may be favored.

Fig. 11 shows a style of ornamental poles used in Buffalo, N. Y.

After all, interruption of service is what the citizens wish to avoid. Some of the systems have decreased the number of interruptions and outages to such an extent as to amount to less than one-half of 1 per cent per night. This is a wonderful record, and could be attained only by reason of the improvements which have been effected in electric arc street lighting.

The members may well ask at this point to what extent have these improvements been carried out. In New England territory practically 70 per cent of the street lamps installed represent the enclosed arc system. In the New York territory, the figure is nearly as high. Through the entire United States the enclosed arc system is being installed at the rate of 50,000 arc lamps annually, and there are already installed upwards of 150,000 enclosed street arcs in all sizes of cities and towns in this country.

I do not hesitate to claim that the methods of the electrical companies for disseminating new ideas are second to none. To illustrate, the New York Edison Company issues a monthly bulletin to its customers. This bulletin reaches all classes. In connection with residence lighting, the families read the electrical news. In connection with the various classes of mercantile work, the proprietors of large and small stores alike, read this bulletin. It is one of the most widely published pamphlets issued, and, as if in honor of your association's meeting today, their last bulletin was particularly devoted to ornamental street lightin. I claim that the electrical industry has attained an enviable position when almost every man, woman and child in the residential district, and nearly every proprietor, clerk and boy in the commercial days, to erad the most advanced ideas in district, has an opportunity, every thirty connection with electrical improvements. If, in the future, such methods of disseminating new ideas in connection with the electrical industry shall continue, the cause of ornamental street lighting will be greatly advanced, and Municipal Improvement Associations will have reason to rejoice

Further, regarding the method of promulgating advanced ideas on municipal improvements in connection with electric street lighting, one of the largest manufacturers of arc lighting material in the world has issued, in the past few years, hundreds of thousands of pamphlets, profusely illustrated and recommending most modern arc lighting practice to the electric lighting companies throughout the country. This company will issue upwards of 50,000 of such pamphlets during the lighting season, which will be representative of hearty co-operation along the lines of municipal improvements.

ROADS AND PAVEMENTS

Street Pavements—Cost of Brick and Asphalt—New York Rapid Transit—Oil on New Jersey Road—Bids on Patented Pavements—State Aid in Ohio—Bitulithic Contracts in St. Louis.

Street Pavements.*

By Louis M. Pfeiffer, Denver, Col.

A street pavement is strictly speaking

ticular one of these materials is best suited to the requirements, and, second, having decided upon the material, which

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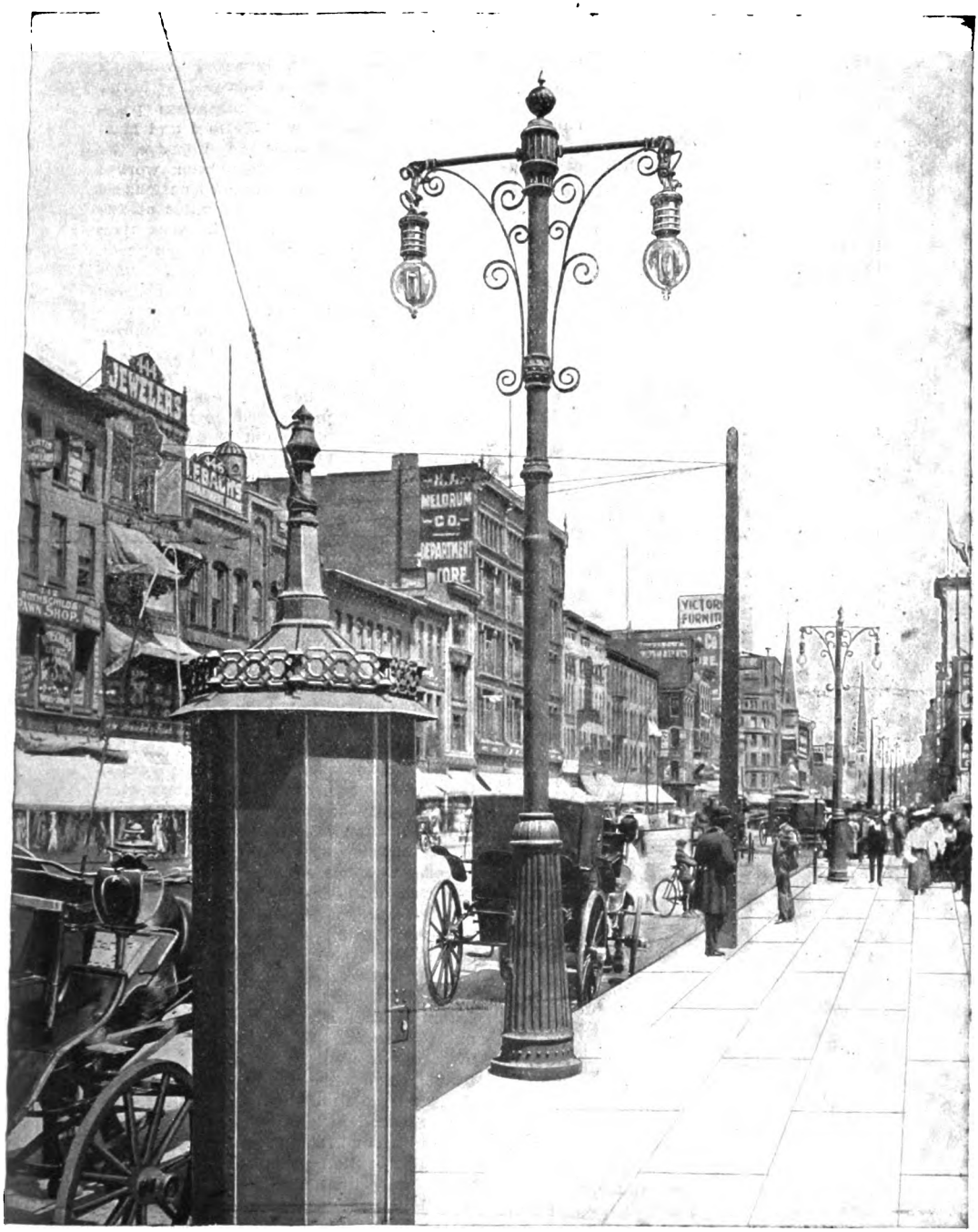

FIG. 11—ORNAMENTAL POLES IN BUFFALO, N. Y.

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brittle and friable and the edges are liable to be broken by the blows of horses' feet. A great improvement has been made in the burning of brick in the last twenty years, but at the best the pavement is noisy and slippery and is objectionable for these reasons.

Wood, as a paving material, has been widely used for some thirty-five years, and its good and bad qualities are well-known. The recent processes of forcing creosote, rosin and other materials into the fiber of wood blocks have undoubtedly increased their life, but add materially to their slipperiness.

Stone is the oldest of paving materials and in one form or another has always been used to a greater extent than all other known pavements. Roman roads were paved with blocks of hard stone about one foot square and eight inches in depth. Broadway in New York was once similarly paved.

Round cobble was the next form of stone pavement. This possessed the merit of cheapness and afforded good foothold, but had the de-merit of roughness and noisiness. Baltimore today enjoys the pre-eminence of being the only city that has recently laid this form of pavement and she is now fast abandoning it. Philadelphia in 1883 had 530 miles of cobble stone pavements, while Brooklyn still has large areas of cobble, which, as in Philadelphia, is fast being replaced with other forms of pavement.

The next form of stone used was five-inch cubes of hard trap. This was first laid in Brussels, then imported to Paris and from there to America, where it has become widely known as the Belgian block. This block had the objection of having too many longitudinal joints which wore into ruts. The next step was to lengthen and narrow the blocks so as to decrease the number of longitudinal joints, which gives the present standard block pavement. Such pavements are the most durable known. The very best of them are rough and noisy.

In the form of macadam with or without the Telford foundation of large stones, stone has been used as a road covering in Europe and America for nearly a century.

John Macadam in 1816 discovered the value of wedging the large stones together by heavy pressure. He realized that this gave rigidity but not density. Water found its way down through the

Telford in 1820 on discovering that the water soaked through John Macadam's surface and wet the foundation, often making it boggy and permitting the pavement to settle, invented what is known as the Telford base.

The students of the macadam pavement from the time of Telford and Macadam have done little to improve its condition. Macadam has been worked with by nearly all the civilized nations on the globe and thousands of miles of fine road are the result, more in area than that of all other pavements combined, but with the exception of a little more care in the selection of the stone, the use of much heavier rollers together with a better system of maintenance, macadam is the same now that it was seventy-five years ago.

Good road builders, however, have learned that the Telford foundation is not necessary to prevent the foundation from softening and settling. Large steam rollers are used to compact the ground and better drainage is offered to carry off most of the surface water, and it is very seldom today that we hear of a macadam road failing because of settlement.

The mines of asphalt rock in the Val de Travers, Canton of Neufchatel, Switzerland, were discovered in 1721, but it was not until 1849 that the utility of the material as a road covering was noticed. The rock was then being mined for the purpose of extracting the bitumen contained in it for use in medicines and the arts. It was observed that the pieces of rock which fell from the wagons were crushed by the wheels and, under the combined influences of the traffic and heat of the sun, a fair road surface was produced. A macadam road of asphalt rock was then made and gave fair results and finally in 1854 a portion of one of the boulevards in Paris was laid with pressed asphalt on a concrete foundation. From Paris its use extended to London in 1869, and it has been used to a considerable extent in Berlin. The success of the asphalt pavements in Europe led American inventors to seek to manufacture a material which should have similar qualities, and the first idea was to utilize the tar produced at gas works. The result was twelve or fifteen different compounds, and all essentially composed of sand and tar. Large quantities of this pavement

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ly unsuitable for roadway construction. The work was done at ridiculously low prices by contractors who had no previous familiarity with the construction of bituminous pavements or incentive to improve; in fact, at the time the pavements were laid no one in this country or Europe had any accurate knowledge of the requirements necessary to produce good work. A few of these pavements, however, are in use today, even on roadways, and have been in use much longer than any asphalt pavement in existence in this country or Europe.

All failures can be traced to the use of inferior grades of coal tar and improper methods of preparing the cement, and the use of improper sand in the wrong proportions.

The early failure of the coal tar composition pavements put them almost entirely out of use in roadway construction. A German chemist, Prof. DeSmedt, had secured a patent on a formula for making an asphalt surface, using natural asphalt as a cementing material. Experiments were made with Mexican, Cuban and Trinidad asphalt. The so-called Albertite, Gilsonite and other bitumens found in this country were also tried, but generally without success.

Samples of the Trinidad Lake asphalt pavements were laid in Newark about 1870 and New York City in 1873, respectively, but it was not until 1876 that a pavement was laid on a large scale.

In 1876 Pennsylvania-ave., in Washington, was in an almost impassable condition, being covered with rotten wooden pavement. Congress directed its repaving and appointed a commission consisting of Gen. H. G. Wright and Q. A. Gilmore of the corps of engineers, and Edward Clark, architect, to have supervision of the work. The terms of the law directed them to lay the best known pavements. They advertised for proposals, making no restrictions as to materials. They received forty-one proposals for every variety of stone, wood, macadam and bituminous pavements. Out of them all the commission selected two and laid these respectively on two-fifths and three-fifths of the avenue. These were the natural rock asphalt from Neufchatel and the Trinidad Lake asphalt mixture. Both pavements were completed in the spring of 1877. The Neufchatel pavement lived a life of about ten years, while the Trinidad Lake mixture is still in use after much repair and two complete new surfaces.

Prof. A. W. Dow, inspector of asphalts and cements for the District of Columbia, recently certified that a pavement composed of coal tar cement manufactured by E. B. Warren & Co. of Washington had been in successful use on Massachusetts-ave., Washington, for thirty years and the expense of maintenance has been less than one cent per sq. yd. a year during that whole time.

Referring again to the old pavements, Prof. Dow said: "In fact the long life of this and other old pavements can only be looked upon as a lucky accident and it is a remarkable illustration of what coal tar bitumen can be even under unfavorable circumstances. The many failures of the past indicate how they can be avoided in the future, and the valuable lessons learned from these failures, together with the scientific methods employed in the construction of the Warren pavements, insure uniform success for the future."

It seems to be a fact that the early asphalt pavements caused as much annoyance to the promoters as did the early coal tar pavements, but they were generally laid at a good margin of profit, under a guarantee system which justified and encouraged the most careful methods and immediate repairs to defects.

The business has developed from one of insignificant proportions to an industry carried on in about 100 cities in the United States. The merits and demerits of the pavement are well understood. When the asphalt pavement was first introduced it was considered to offer more advantages than any other pavement then in the field. Probably the most successful form of asphalt pavements has been that of the Trinidad variety, but this is partly because they have generally been laid with greater care and under scientific advice.

Asphalt is a name applied to a certain form of bitumen found in nature, and is generally a mixture of sand, dirt, clay, shells or limestone with natural bitumen. It is manufactured into cement by mixing it with other forms of bitumen, and this cement is in turn used to bind together particles of sand and fine or pulverized limestone as in the modern Trinidad asphalt pavements. No two asphalts are alike, and the life of the pavement depends somewhat upon the crude material, but more upon the skill in its manufacture into asphalt cement, and more still upon the proper proportioning and mixing of the cement with the sand and dust and in the selection of the mineral matter. It requires a large amount of experience to know how to combine the material. When the Trinidad asphalt pavement was first introduced no bitumen had

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been known up to that time which was not waterproof and unaffected by water, and it was presumed that the Trinidad asphalt had these qualities. The greatest cause of failure in the Trinidad asphalt pavement is owing to the fact that the asphalt rots in water, and any minute sections of the thickness surrounding the sand particles in the asphalt pavement, will disintegrate in water. This weakness of the Trinidad asphalt was not thoroughly understood until very recent years, and the best road builders were at a loss to understand why the surfaces were so liable to disintegrate. Only when the mixture of sand used is so fine that water cannot penetrate the mixture, does the pavement show lasting qualities when subjected to moisture. At the introduction of the asphalt pavements, the proper rolling of foundations was not in vogue with any form of pavement, and engineers jumped to the conclusion that the hydraulic concrete foundation was essential.

The smooth surface of the hydraulic concrete has no union with the wearing surface of the asphalt pavement, and the tendency was for the surfaces to slide on the foundation, thus forming depressions or cups which would hold water, and this water standing on the asphalt had the effect of rotting or disintegrating and separating it from the sand, and a hole would soon follow. In an asphalt pavement composed of sand and asphalt it is impossible to use a sufficient amount of the asphalt cement to make a thoroughly water-tight roadway. This is because sand contains 27 to 45 per cent of voids or air spaces. Asphalt cement suitable for binding this sand togother must be flexible material, and if a sufficient quantity of the asphalt is mixed with the sand to thoroughly fill the air spaces, the surface is sure to shift and roll unless the asphalt is tempered so hard that it will surely crack and crumble in winter, which would be objectionable. As it is, the saturation of water into the surface of the asphalt pavement is the most common cause of deterioration, disintegration and ultimate failure.

When well built and kept in good condition the macadam pavement furnished one of the most pleasing roads, and if it could be kept in perfect condition would stone, it binds better, but wears rapidly. If the roadway is kept moist, not wet and not dry, the natural paste or mortar holds the stone in place fairly well; if the surface is wet the binding material is converted to mud and washes away as is the case with excessive rains; if the surface is dry the binding material is converted into dust and blows away. This uneven surface induces more wear and more binding material is provided and the process continues, and the absence of binding material causes the stone to become dislodged and holes occur. The result is a roadway expensive to maintain; expensive to keep clean and one which is dusty or muddy a large part of the time and one which, but for improper binding material for the wearing surface, would be the ideal roadway.

In the bitulithic pavement a binding material for hard trap rock is used which does its work at all times and under all conditions and which will last as long as the stone, when properly held in place, will wear under traffic and thus the longest possible wear of the stone itself is secured. Ordinary sand has no firmness in itself, and such fine matter has from 27 to 45 per cent of voids. The firmness of an asphalt pavement must be secured by cementing together the particles of sand with the asphalt, forming an asphalt mortar. The sand and the asphalt cement are mixed in a heated condition and then spread on the street and rolled, and on cooling the asphalt mortar is set. The difference between asphalt which is too hard so that the pavement will crack and be brittle when cold in winter and one which is too soft so that the pavement will shift or roll in summer is very slight.

In the bitulithic process we are enabled to overcome the errors which occur in the pavements referred to.

First—By using only the best quality of coal tar and by properly refining the same, securing an absolutely uniform cement such as was not and could not be procured when the earlier coal tar pavements were laid, we have a cement which is much more adhesive to mineral matter and one which is absolutely unaffected by water.

Second—By using coarse stone, which in

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be used at a temperature where there is no tendency to destroy it by overheating during the process of mixing the wearing surface.

Third—We reduce the voids by separating crushed stone into six or more sizes and using exact proportions of the varying sizes, using as much of the coarsest size as would be used if none other were present and adding in the materials of receding sizes in such proportions as to fill the spaces between the coarsest sizes, and thereby accomplish a mineral mixture before the bituminous cement is added, which is 91 per cent solid stone, so that the voids do not exceed 9 per cent and the bituminous material used is sufficient to thoroughly fill all the voids and coat all the stone and thus the bitumen is not minutely subdivided and exposed to the weather as in the asphalt mixture. On account of the inherent stability of the mixture, its greater density and the greater softness of the cement, the cement itself has greater life than was possible in former mixtures. The durability of such a roadway depends upon the amount of actual abrasion of traffic, which the stone used in the mixture will sustain when properly held in place. The bituminous mortar used between the stones supplies a cushion which reduces the wear on the stone, makes it absolutely waterproof and protects the stone from softening influence of water. Among the greatest advantages of the pavement in addition to its great durability is that it is the least slippery of any pavement which has yet been constructed, and it is in successful use on 13 per cent grades.

The foundation for the pavement should always be thoroughly rolled with a heavy roller and after proper rolling has been accomplished, the bituminous concrete foundation used with the bitulithic pavement offers many advantages over the hydraulic concrete foundation used with the asphalt pavement. After the stone in the foundation is thoroughly rolled with heavy rollers, the bituminous cement is poured over the same for the purpose of binding it together. Into this foundation the wearing surface is rolled and is welded into it, and there is no danger of slipping or sliding of the surface as is an asphalt pavement. After the wearing surface has been compacted with a fifteen-ton three-wheel road roller, having several times as much compression to the running inch as the ordinary asphalt roller, the whole surface is thoroughly coated with bituminous cement for the purpose of closing up any honeycomb or surface voids which may appear between the coarse particles of stone, and into this cement is thoroughly rolled trap rock chips adhering to the cement and presenting a gritty surface to the wear of traffic.

Cost of Brick and Asphalt Pavements in Various Cities.

An investigation of the cost of brick paving in Chicago by the Chicago Inter-Ocean brings out the fact that the average cost is $3.50 a sq. yd. In order to make a comparison the city has written to 100 municipalities asking for figures, and has received a number of replies. These show that in the cities of Indiana the cost of vitrified brick paving varies from $1.25 to $1.45 a sq. yd. In Iowa the prices range from $1.20 in Keokuk to $1.50 in Dubuque. In Ohio, from sixty cents in Zanesville to $1.40 in Columbus. In Michigan, from $1.32 in Saginaw, famed for its brick pavements, to $1.60 in Grand Rapids. In Illinois, exclusive of Chicago, from $1.10 to $1.50. Brick paving in Evanston costs from $1.35 to $1.50. In Philadelphia it costs $1.40 and in St. Paul $1.90 a sq. yd. Richmond, Va., whose paving is done entirely at the city's expense, pays $2.20 a sq. yd.

The cost of asphalt paving in other cities is also being investigated. Columbus, O., pays the most, $2.75 a sq. yd., and Richmond, Va., is second at $2.70. Most of the cities pay from $1.75 to $2 a sq. yd., and about six cities pay as low as $1.53. Until very recently Chicago paid $3.50 to $4 a sq. yd. for asphalt paving, but the price has been reduced to $3 a sq. yd. This reduction is said to be the result of private parties inducing outside contractors to enter into competition in the city's work.

Progress on the New York Rapid Transit Tunnel.

The Rapid Transit Subway in New York City will, in all probability, be opened in June, the date not having been determined as yet. If it is found, however, that the subway cannot be completed—the situation depends entirely on labor complications—the opening will take place later in the summer. Up to date the tunnel has cost the city $31,089,900, with $2,312,000 for extra work. The contractor, John B. McDonald, is ultimately to receive $6,500,000 for the tunnel work proper. The extra work and the purchase of real estate for terminals and the acquirement of easements will make the city's tunnel bill about $40,000,000 by the time the road is fully running.

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Oil on Road at Westfield, N. J.

An experiment is being made at Westfield, N. J., in the use of tar sprinkled over a macadamized roadbed to abolish dust and mud. An ordinary country road sixteen feet wide and in two sections of about 1,000 feet each, was selected for the experiment. On one the tar was run over the roadbed with the dust and screenings just as they lay. On the other the road was swept to the hard surface and then the tar applied. The result, in both instances, seemed to meet with the approval of the roadmaking experts present. The tar was applied in a very crude manner, being put on by hand from a big watering can. After being on the road only three hours it had penetrated nearly an inch, and in a short time after it was laid there was no tracking on it, and it did not spatter on wheels driven over it. The cost of treating a road in this way is estimated at $400 to $500 a mile for a road sixteen feet wide. This would require 3,000 gallons of tar to the mile. Owners of automobiles and the driving public are watching the experiment with considerable interest.

The scheme has been very successfully tried in France for some time and has given much satisfaction to automobilists.

Bill to Permit Bids on Patented Pavements in New York.

A bill was introduced in the New York Legislature March 16 providing that no patented pavement shall be laid in New York City unless the borough president or other officer having authority to contract to lay the same, shall in his notice to bidders ask for bids on some other form of pavement in addition to the patented pavement, and no contract shall be awarded for a patented pavement unless bids have been received for some other form of pavement. In the event the bid for the patented pavement shall not be the lowest bid, a contract shall not be awarded for said patented pavement unless the board of estimate and apportionment shall authorize the officer receiving the bid to accept it. The bill was introduced by Assemblyman Bostmissioner Willcox was advised to ignore the charter and advertise for bids for an asphalt pavement in which the specifications were not the same as the charter provided for. The Barber Asphalt Company objected and the matter was taken into the courts, where the contention of the company was upheld. The only way to get around the matter, therefore, was to have the charter repealed. Mr. Bostwick's bill permits bids to be received for pavements where the articles are patented.

State Aid for Road Building Proposed in Ohio.

A bill has been introduced in the Ohio Legislature providing that any roads, not in an incorporated municipality, the plans and estimates for which have been properly made by the County Surveyor on petition of the property-owners along the road and the township trustee, may be constructed by the County Commissioners. The plans are filed with the State Board of Public Works. When the work is completed, as certified by the Surveyor, the County Commissioners make requisition, endorsed by the State Board of Public Works, for 40 per cent of the cost upon the State Treasurer; 40 per cent is paid by the County Treasurer from the county road fund, on order of the County Commissioners, and 20 per cent is paid by the Township Trustees, which portion may be collected from the abutting property owners under procedure laid down.

The roads are divided into four classes, national highways, to be improved 15 to 24 feet wide; State roads, 12 to 20 feet wide; county pikes, 9 to 17 feet wide, and township roads, 6 to 10 feet wide.

The Township Trustees can be compelled to construct bits of road less than one mile in length required to connect State aid roads previously constructed.

Road machinery, supervisors, dissemination of information, precedence of roads in the same township, and annual appropriation of $220,000, not more than $2,500 to go to any one county in a year, repair of roads by Township Trustee un-

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Bituminous Macadam Contracts in St. Louis Upheld by Supreme Court.

The decision of the Circuit Court in the case of William H. Swift against the City of St. Louis, involving the validity of contract for Warren's bitulithic pavement, will be found in brief in Municipal Engineering, vol. xxiv, p. 284.

The decision of the Supreme Court on appeal was indicated in vol. xxvi, p. 205. The full text of the decision has now been received and is of sufficient interest to warrant a rather full abstract.

The suit was one in equity against the city and the Board of Public Improvements to enjoin the said board from making a contract for the pavement of W. Pine-boulevard with "bituminous macadam" under city ordinance No. 20,822. This suit is based upon the alleged invalidity of said ordinance providing for said pavement

Section 27 forbids the assembly to directly contract for such work or improvements contemplated by the charter, or to fix the price or rate therefor, but in all cases, except in cases of emergency work or necessary repairs, the board shall prepare and submit to the assembly ordinances with an estimate of cost thereof endorsed thereon, authorizing the doing of any proposed work and under the direction of such ordinance shall advertise for bids in the papers doing the city printing three times, the last publication to be at least ten days before the day appointed for the opening of the bids, stating the general nature of the work to be done and time and place when the bids shall be recived, and shall let the contract to the lowest responsible bidder Any other mode of letting out or contracting for work shall be held illegal and void.

On June 3, 1902, the said board at a regular meeting selected "bituminous macadam" as the material for the reconstruction of said street, and recommended to the Municipal Assembly an ordinance therefor.

Among the specifications of material to be used for the reconstruction of the street it was required that the pavement should be of certain compositions prepared by one Warren, and known as "Warren's No. 1 Bituminous Semi-Liquid Composition," "Warren's Brand," and Warren's No. 24 Puritan Brand," and "Warren 's quick drying bituminous flush-coat composition."

The specifications are then briefly put forth. In the published notices no reference is made to the Warren mixture.

The petition alleges that the ordinance was void for the following specific reasons:

First—That it arbitrarily deprived the land owners of the benefit of competition, in that bituminous macadam was not an original composition, but a well-known composition of an original material made up of broken stone and any bituminous substance used as a cement or binder; that the Warren materials specified were not patented articles, and were nothing but certain grades of coal-tar branded with Warren's name, and that the specifications thereof precluded competition and designated Warren and his associates as the sole bidders, and that this arbitrary specification was in violation of the rule of competition prescribed by the charter.

Second—The ordinance did not specify all the material with which said bituminous macadam should be composed, nor did it fix the manner and general regulations under which it should be constructed, as required by the charter, but left the entire composition thereof, other than the arbitrary selection as aforesaid of the Warren mixtures, to the discretion of the Street Commissioner, and thus unlawfully delegated the power and authority of the Board to the Street Commissioner.

Third—That the public notice did not state or warn the property owners that the bituminous substance to be used as a cement should be those produced and controlled by Warren, designating the pavement simply as "bituminous macadam," which name did not imply or suggest the designation of any specific manufacturers' brand of binding material.

The petition also alleged that bituminous macadam was an untried experiment, and had never been demonstrated by efficient use for a series of years that such pavement would constitute an efficient wearing surface under city traffic. That the board had advertised for bids for a contract under the ordinance and would enter into a contract and issue special tax bills against plaintiff's property unless restrained by the court.

The answer admitted the ordinance and their proposed making of a contract thereunder as alleged and that said proceedings were in all things regular; that there was only one pure waterproof macadam which had been tried or tested and that this was a pavement composed of the Warren mixtures, that the specifications were as full and complete as the nature of the subject would admit.

1. It is conceded by the learned counsel for the plaintiff that this court in Asphalt Company vs. Hunt, 100 Mo., 22, held that the City of St. Louis, under its charter, was not prohibited from letting a contract for paving a street with materials covered by letters patent; that to hold otherwise would be to deprive the city of the right to enjoy the benefits of modern invention. When that question was again raised in Verdin vs. the City of St. Louis, 131 Mo., 26, the Hunt case was reaffirmed and the doctrine as to patented material was extended to a material whereof the owner had a monopoly by reason of his exclusive ownership of the natural supply of such material.

As was said in the latter of those two cases, so many contracts had been entered into on the faith of the decision of this court in the Hunt case, that it had

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practically become a rule of property and that it was too late to disturb that ruling. But it is insisted that those cases went too far, and while the court might not disturb them on the principle of stare decisis they ought not to be extended because to do so would strike down the last protection of the abutting property owners against discrimination and favoritism in contracts for public improvements which are made a charge in invitum against the private citizen. The insistence is that the facts of this case do not bring it within either the principle of a government patent nor yet within the Verdin case, a monopoly based upon the ownership of the only source of supply of a natural product, but it is a designation by the Board of Public Improvements and ratified in the ordinance by the Municipal Assembly, of certain brands of a certain manufacturer of a well-known mercantile article, preparations of coal tar, and in so doing the board and the Municipal Assembly deprived the tax-payers of all the benefit of competition which the charter secured to them in the letting of public work.

On the other hand the city maintains that its Board of Public Improvements and its Municipal Assembly are vested with the power to determine the character of street improvements and the courts will not undertake to interfere with the discretionary powers of its officers within legal bounds; that when a city in the prosecution of a public work finds an article or material which in its judgment is best adapted to such work it is not debarred from availing itself of it because such material is controlled by one party. The Circuit Court dismissed the bill and held that the city authorities were authorized to specify Warren's brands of coal tar cement as the binding material in the construction of a bituminous macadam pavement.

After a careful reading of this record we gather that for many years pavements have been made of coal tar and coal tar productions, but the difficulty encountered was the inability of the tar preparations, and we think the burden of the proof was that coal tar cement properly made is a most excellent binding for macadam; that it resists water when properly made. A notable case is of a pavement laid in Washington City thirty years ago and which is still in excellent condition, but it had been discontinued by contractors be-

There was, then, this condition confronting the Board of Public Improvements and Municipal Assembly when they came to decide what material they should adopt for the reconstruction of W. Pine-boulevard. The bituminous macadam had the advantage over asphalt pavement in that horses were not liable to slip and fall on it, especially in cold weather. It was sufficiently strong owing to the rock in its composition to carry great weight and the coal tar cement was impervious to water and would make an enduring pavement. A large number of other cities were using it to advantage. They were desirous of testing it, but they were advised that the only proper binding for the macadam known up to that time was the Warren's cement, and accordingly they required that cement in the specifications submitted.

The main contention of plaintiff is that by so specifying Warren's brand they have prevented competition and thus violated the charter. This question is by no means a new one. While the learned counsel for plaintiff urges that coal tar is a common article of merchandise and that the specifications should not have been limited to Warren's brands of coal tar cement, we think the proofs demonstrate that up to this time there was only one such cement so made as to be equal and uniform. How, then, can it be said that in adopting the only proper cement known for the binding in a bituminous macadam pavement the board exceeded its authority any more than it would have done if it had adopted an asphalt pavement and specified Trinidad Lake asphalt as the material?

This court approved the Trinidad Lake asphalt specification in the Verdin case because the monopoly therein resulted from the ownership of the whole natural supply of that article. Can it make any material difference that that supply in this case is the result of a long and persistent effort to produce a uniform cement? In each case the owner has the only material which the city desires to use. Having held, as this court has in the Hunt case, 100 Mo., 22, and in the Verdin case, 131 Mo., 22, that the city is not precluded from using the best material because it is a patented article or a monopoly which denied competition, how can it be consistently ruled that it cannot use a desirable article because only one firm manufactures it? It is not answered by saying other persons might

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erly so, too, that they might as well have specified Warren's brands directly as to have done so by indirection?

In the case of Schoenberg, vs. Field 95 Mo. A 241, it was properly ruled that when the Board of Public Improvements arbitrarily selected vitrified brick of a certain make, when the Board's own records disclosed that other manufacturers made brick of the approved standard, it was a denial of competition and void. In this case we find from the evidence that there was but one known manufacturer of coal tar cement of equal uniform quality and that was made by Warren Brothers. Had the evidence disclosed that other manufacturers made a coal tar cement suitable for binding the rock in the macadam, we think it would have been the duty of the Board to select a standard of such cement and require bidders to conform to that standard and provided proper tests, but where, as in this case, the whole supply is owned by one individual and it is the only suitable article for the public improvement, we see no reason for denying the city the right to avail itself of it if we are to adhere to our former decisions permitting the city to use patented articles and materials in which one party has a monopoly by the ownership of the material supply.

II. As to the objection that the specifications did not call for coal tar cement in so many words, but named Warren's Puritan Brands, the evidence clearly indicates that all the contractors understood fully that these brands were coal tar cements.

III. The notice to the property owners to consider the improvement we think was a substantial compliance with the Charter, referring as it did to the specifications on file in the office of the board and street commissioner. Nor was the ordinance void because it left certain details to the discretion of the proper city officials. The evidence disclosed that such details amounted to an infinitesimal proportion of the work.

In consideration of the whole record we think the judgment should be and it is affirmed.

The fact that the bituminous madaccam pavement is patented was not mentioned in connection with this case and it is therefore not touched in the decision.

REFUSE AND SEWAGE DISPOSAL

Bacteria and the Septic Tank—Refuse Destruction in Burnley.

Bacteria and the Septic Tank.

In an interesting article on methods of sewage disposal for Baltimore, written for the Baltimore Sun, the following concerning the methods of operation and the operators in a septic tank appears:

The fourth method of sewage disposal is by means of the septic tank, in connection with small filtering beds composed of layers of sand, gravel and stone or coke. This is the latest development in sewage purification and perhaps the most efficient, if not the cheapest. The bacteria are given special facilities to do their work—to eat up the organic matter in the sewage and then eat each other. It is called the "natural method," since it frankly turns the whole work over to the natural agents, first of putrescence, then of ordinary innocuous decomposition.

In one cubic inch of sewage there have been found 17,000,000 bacteria that work without air (anaerobic), 5,000,000 of these having the power to liquefy solids. The same cubic inch had eighty-five more millions of bacteria that work or feed only where they can get air (aerobic), and of these about 8,000,000 could liquefy solids. Those which work without air produce putrefaction, resolving organic matter into carbonic oxide, marsh gas and sulphuretted hydrogen, inflammable and poisonous gases of ill odor. They do not reduce organic matter into its simplest forms, but into these objectionable compounds. The aerobic bacteria, on the other hand, carry the dissolution to its lowest terms and produce innocent products which have no smell.

One cubic inch of sewage such as is found in our cesspools contains sometimes as many as 510,000,000 of bacteria. These are of various species, the innocent bacterium coli communc (from the human body) being very abundant. Dis-

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ease-producing bacteria are comparatively rare, being found only when a typhoid patient or other patient suffering from an infectious disease has recently contributed to the contents of the cesspool. It is a fact of capital importance that of the 440 known kinds of bacteria 190 kinds liquefy gelatine upon which they are placed and some of them do a useful work in liquefying the solid organic matter of sewage.

According to Bujivid, 800,000,000 bacteria would weigh one-sixty-sixth part of a grain and 289,000,000,000 one pound. They multiply with amazing rapidity by dividing, each half being as much father as son. If, as supposed, the division takes place as often as once every hour, then in twenty-four hours one bacterium will reckon his posterity at 16,500,000, and in one week he will require fifty-one figures to give their number. After five days his posterity would equal in volume the entire ocean. But bacteria are kept within limits by want of moist food and by their cannibalistic way of eating each other, to say nothing of enemies and the unfavorable conditions they find and make for themselves.

The bacteria which produce fever are said to be rather delicately constituted and fall a prey to others and the same is to be said, it is believed, of other disease-producing bacteria. But if the typhoid bacterium escapes from the cesspool into the soil, being carried along by the leaking sewage, he may survive weeks and months and have the luck to be carried by a particle of dust into the pantry. Or he may be carried from the cesspool on the proboscis or feet of a housefly to a milk pail or dish of fruit and thus find his way into the body of a susceptible person whose vitality has been lowered by breathing air contaminated with exhalations from the cesspool.

Bacteria operate both where inorganic matter is to be converted into organic matter and where organic matter is to be broken into its inorganic constituents. They "fix" nitrogen for example, taking it from the atmosphere and supplying it in a utilizable form to the roots of clover, atmosphere, thousands to the cubic inch of air, and begin at once to grow and multiply as soon as they fall upon a moist organic substance at the right temperature.

Refuse Destruction in Burnley, England.

The installation of plants for the destruction of refuse has become quite frequent in English towns and cities. It is the fashion upon the successful inauguration of a plant to issue an illustrated souvenir describing the buildings and apparatus and showing the results of the operations.

One of the recent souvenirs of this sort is that of the Meldrum refuse destructor and power plant, installed at Burnley and first fully worked in April, 1903. The souvenir is dated January, 1904, and gives a report of the results of the works after they were put in full working order. The following description of the plant is taken partly from the souvenir and partly from a report of a visit to it.

The first destructor erected in the corporation was a "beehive" in January, 1884. It disposed of 1,000 to 1,400 tons a year at an average cost of 3 shillings 4 pence a ton. In 1894 another type of destructor was installed, but failing in its duty was discontinued for some years, again being put in use with radical modifications in the years 1898 to 1903, when the present plant began operations.

In the center of Burnley is the tallest chimney in the district, towering high above its fellows of the same base level. A few years ago, when the first destructor was at work, you might have seen a thin haze about the top, but what was more, the residents in the vicinity complained of small portions of unconsumed refuse being discharged from the top to fall into the streets, causing an undesirable smell. Now, however, the chimney appears idle. No sign of smoke is visible at the mouth, but nevertheless that is no criterion on which to base a calculation as to the work done at the

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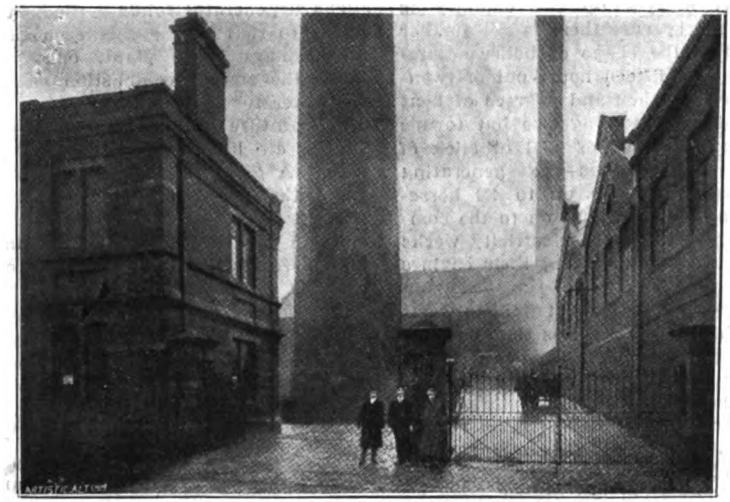
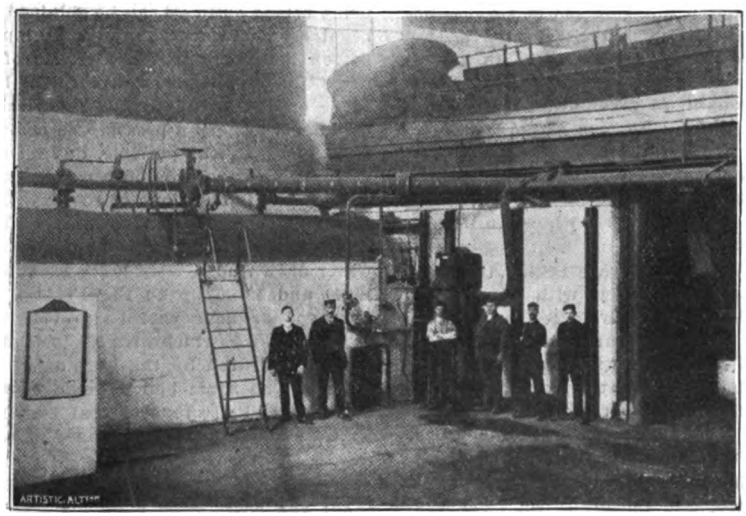


Entrance to Destructor and Electric Plant.



Rear of Cells and Boiler.

REFUSE DESTRUCTOR AT BURNLEY, ENGLAND.

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heat that escapes up the chimney is that unused because there is not further appliance in the shape of boiler accommodation. For fifteen hours out of twenty-four over a thousand degrees of heat —obtained from nothing else but town's refuse, not a "cob" of coal or stick of firewood being utilized—are generating continuously anything up to 400 horse-power, and which is sent on to the common steam fund of the electricity works for the purpose of running their engines and producing electrical power. At one time the whole of this heat went to waste up the chimney. Now, less than one-half of the heat escapes.

A lofty hall is entered, and at the further end are the neither regions, where dirt begrimed men are shoveling rubbish into the furnaces, or stirring up the refuse with long iron rakes or bars, a fierce and hot glow from the grates casting a weird picture indeed. To the right is the old destructor, now unused, and which was erected about five years ago. This was fed from the top, the refuse being shoveled down a shoot to the fire. On account of the matter falling on the top of the fire, and other reasons, the destructor was unsatisfactory. The idea was then carried out of feeding the same cell from two grates at the bottom, which brought about a better state of things the output being doubled, about two tons per hour being nicely got through. This however, was not sufficiently serviceable and to the left has been erected a Meldrum destructor, which seems to answer all that is required of it. The refuse when brought, is precipitated down huge hoppers, and the stokers below shovel the material into the fire grates which are immediately opposite, thus avoiding the rising heat from the fires, and consequent stewing of the refuse while waiting to be burnt.

The continuous grate taking the place of four isolated cells, with the ashpits so arranged, and the forced draught so applied, that practically three-fourths of the total grate is working at full capaci-

The Regenerator fulfils a function analogous to that of the fuel economizer in an ordinary boiler plant, only that it heats the air for combustion instead of the water for the boiler. By this means a temperature of about 350 degrees is given to the air before it is forced into the fires. A great advantage is thereby secured, the furnace temperature being materially increased, and there is no difficulty in dealing with refuse containing a high percentage of moisture, and of low calorific value.

The gases of combustion pass from the furnace into the combustion and settling chambers, where most of the dust collects and is readily removed daily by means of convenient doors. Ample provision is also made for cleaning out the boiler flues, etc.

The clinker is taken to one side and allowed to cool, the larger pieces are sent to the filtration beds at the sewage works, and the smaller go to the tips and filling-up places.

The terrific heat that is generated by the high temperature system is not allowed to go to absolute waste. Situated behind the furnace is a large Lancashire boiler, 30 ft. by 8 ft., with two tubes. It is specially adapted for being treated from the combustion chamber. With coal fuel the boiler would be capable of producing 250 to 300 horse power, but by using refuse quite 400 can be obtained, and regularly it is working at over 300 h.p. for fifteen hours a day. The efforts of the firers are directed, whatever call is being made on the steam by the electrical department, to keep a pressure as near uniform to 130 lbs. as possible, and an automatic register records on a circular chart exactly the fluctuations of the day. Other records are kept, and we find that for the week ending Dec. 5 the gallons of water drawn upon were 10,540, 10,520, 11,600, 10,640 and 12,270 up to the Friday. The average per hour varied in that week from 716 to 920, which give 360 to 460 horse power generated by the burning of pure

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CEMENT AND CONCRETE

Ingalls Building—New York Building Regulations—Concrete Factory—Cement Manufacturers at St. Louis—Cement Paving Brick—Indianapolis Testing Laboratory.

The Concrete Steel Construction of the Ingalls Building, Cincinnati.*

By H. C. Brubaker, Indianapolis, Ind.

This committee was instructed to investigate and report on the bold project of building a sky-scraper, sixteen stories high, entirely of re-enforced concrete, and without a structural steel member. The ambitious plans of the promoters are no less striking, now that their plans have been carried out with success.

A monolithic mass, 100 by fifty feet in plan—twenty-one feet below grade, and 210 above grade—in which the footings, columns, walls, girders, beams and floors are all one and the same, differing only in shape and position, and continuous, without a joint or break, from the foundation to the cornice, and built of particles, so to speak, all of which could pass through a one-inch screen, with no member larger than three and one-half inches in diameter, is a marvel which rivals the pyramids.

The system used throughout the building is the Ransome system, which consists of twisted bars embedded in concrete. The columns are from 12 by 12 to 34 by 38 inches, and carry as high as 750 tons at the footings. The column stools are built of cast iron embedded in concrete and are particularly interesting in design. The sizes of the columns were limited by the architectural design, and the deficiency in strength was made up by the iron bars, there being from four to eight 3½-inch bars to each column, bound together by hoops of wire each 12 inches in height. The girders have as large spans as 33 feet and are from 27 to 36 are 8 inches thick and some walls next to adjoining buildings are as little as 3 inches thick. Of course, these walls carry no loads.

The first to third stories are veneered with marble, which is supported by projections from the concrete fitting into grooves in the marble. The upper stories are veneered with brick, which is supported at each story height by a ledge of concrete.

The general features are strikingly similar to steel cage construction; in fact, the design is the same, and the loads, strains and stresses are figured in the same manner.

It is hardly our province to predict the weathering of this structure. Time only will prove its durability. But the large amount of money was expended, and the enormous responsibility was assumed by men, who evidently were thoroughly convinced of the success of their undertaking.

The same contractors (the Ferro-Concrete Construction Company) are building a factory building for the American Book Company in Cincinnati five stories high, with a floor load of 400 pounds per square foot. An interesting incident in this connection is the fact that they bid for this building in competition with mill construction and were only 4 per cent higher than the bids for mill construction. The writer is at a loss to understand this small difference in cost between the two constructions, and is inclined to believe that they took the contract at little or no profit.

Regulations of New York City for Con-

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regulations shall be understood to mean an approved concrete mixture reinforced by steel of any shape, so combined that the steel will take up the tensional stresses and assist in the resistance to shear.

2. Concrete-steel construction will be approved only for buildings which are not required to be fireproof by the building code, unless satisfactory fire and water tests shall have been made under the supervision of this bureau. Such tests shall be made in accordance with the regulations fixed by this bureau and conducted as nearly as practicable in the same manner as prescribed for fireproof floor fillings in Section 106 of the Building Code. Each company offering a system of concrete-steel construction for fireproof buildings must submit such construction to a fire and water test.

3. Before permission to erect any concrete-steel structure is issued, complete drawings and specifications must be filed with the Superintendent of Buildings, showing all details of the construction, the size and position of all reinforcing rods, stirrups, etc., and giving the composition of the concrete.

4. The execution of work shall be confided to workmen who shall be under the control of a competent foreman or superintendent.

5. The concrete must be mixed in the proportion of one of cement, two of sand and four of stone or gravel; or the proportions may be such that the resistance of the concrete to crushing shall not be less than 2,000 lbs. per sq. in. after hardening 28 days. The test to determine this value must be made under the direction of the Superintendent of Buildings. The concrete used in concrete-steel construction must be what is usually known as a "wet" mixture.

6. Only high-grade Portland cements shall be permitted in concrete-steel construction. Such cements, when tested neat, shall, after one day in air, develop a tensile strength of at least 300 lbs. per sq. in., and after one day in air and six days in water shall develop a tensile strength of at least 500 lbs. per sq. in.; and after one day in air and 27 days in water shall develop a tensile strength of at least 600 lbs. per sq. in. Other tests as to fineness, constancy of volume, etc., made in accordance with the standard method prescribed by the American Society of Civil Engineers' committee may, from time to time, be prescribed by the Superintendent of Buildings.

7. The sand to be used must be clean, sharp grit sand, free from loam or dirt, and shall not be finer than the standard sample of the Bureau of Buildings.

8. The stone used in the concrete shall be a clean, broken trap rock, or gravel, of a size that will pass through a ¾ in. ring. In case it is desired to use any other material or other kind of stone than that specified, samples of same must first be submitted to and approved by the Superintendent of Buildings.

9. The steel shall meet the requirements of sec. 21 of the building code.

10. Concrete-steel shall be so designed that the stresses in the concrete and the steel shall not exceed the following limits:

	Lbs. per sq. in.
Extreme fiber stress on concrete in compression	500
Shearing stress in concrete	50
Concrete in direct compression	350
Tensile stress in steel	16,000
Shearing stress in steel	10,000

11. The adhesion of concrete to steel shall be assumed to be not greater than the shearing strength of the concrete.

12. The ratio of the moduli of elasticity of concrete and steel shall be taken as 1 to 12.

13. The following assumption shall guide in the determination of the bending moments due to the external forces: Beams and girders shall be considered as simply supported at the ends, no allowance being made for continuous construction over supports. Floor plates, when constructed continuous and when provided with reinforcement at top of plate over the supports, may be treated as continuous beams, the bending moment for uniformly distributed loads being taken at not less than WL-10; the bending moment may be taken at WL-20 in the case of square floor plates, which are reinforced in both directions and supported on all sides. The floor plate to the extent of not more than ten times the width of any beam or girder may be taken as part of that beam or girder in computing its moment of resistance.

14. The moment of resistance of any concrete-steel construction under transverse loads shall be determined by formulae based on the following assumptions:

(a) The bond between the concrete and steel is sufficient to make the two materials act together as a homogeneous solid.

(b) The strain in any fiber is directly proportionate to the distance of that fiber from the neutral axis.

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(c) The modulus of elasticity of the concrete remains constant within the limits of the working stresses fixed in these regulations.

From these assumptions it follows that the stress in any fiber is directly proportionate to the distance of that fiber from the neutral axis.

The tensile strength of the concrete shall not be considered.

15. When the shearing stresses developed in any part of a concrete-steel construction exceed the safe working strength of concrete, as fixed in these regulations, a sufficient amount of steel shall be introduced in such a position that the deficiency in the resistance to shear is overcome.

16. When the safe limit of adhesion between the concrete and the steel is exceeded, some provision must be made for transmitting the strength of the steel to the concrete.

17. Concrete-steel may be used for columns in which the ratio of length to least side or diameter does not exceed twelve. The reinforcing rods must be tied together at intervals of not more than the least side or diameter of the column.

18. The contractor must be prepared to make load tests on any portion of a concrete-steel construction, within a reasonable time after erection, as often as may be required by the superintendent of buildings. The tests must show that the construction will sustain a load of three times that for which it is designed without any sign of failure.

A Concrete Factory Building.

The Central Felt & Paper Company has completed at Borden-ave. and Dutch Kill Creek, Long Island City, a building, the main room of which has a clear span of fifty-one feet and is 175 feet long. The beams and the ceiling are entirely of concrete.

The general nature of the soil in Long Island City is soft and spongy. Buildings adjoining the tracks of the Long Island railroad have suffered considerably from the vibration caused by passing trains. In the case of the concrete building the walls of the factory were made first of rough planks nailed to uprights eighteen inches apart. Into this trough the mixture—1 cement, 2 sand and 5 fine cinders—was shoveled, pounded and allowed to set for three days. At the end of this time the board walls were knocked off, and the solid wall of hardened concrete remained.

The problem of constructing the ceiling over the large machine room, in which are to be the huge rollers transforming the pulp into finished paper, was the most difficult which builders with concrete have yet been called upon to solve, says a writer in the Iron Age.

Beams of solid concrete were planned, fifty-one feet long, thirty inches deep and fifteen inches wide, to be placed at intervals of sixteen feet along the entire distance of 175 feet. Timbers were set up on the floor of the machine-room reaching to the level of the ceiling. On these uprights were laid 15-inch planks, and boards thirty inches wide were nailed to them. Into these troughs the concrete, 1 cement, 2 sand, 4 stone, was then shoveled. Favoring weather caused these beams to set in less than three days. The uprights were knocked from underneath them, the bottom and side planks of the trough dropped off, and the finished concrete beams, over fifty feet in length, were fast to the concrete walls. The stiffening used was in the form of small iron rods, placed in rows of three in the lower and upper portions of each beam.

A wire mesh was then fastened between the beams, half way between the top and bottom. The mold of boards was again put in position, and the ceiling was completed.

The factory was first planned to be a brick and frame building, and an insurance company quoted a rate of 1 per cent with a full sprinkler system installed. The rate the same company now offer for the concrete structure is one-twentieth of 1 per cent, although no provision has been made for the sprinkler system.

Exhibit of the Portland Cement Manufacturers.

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tween the halls forming a gateway to the outside exhibit.

The building consists of three halls, separated by two courts, and connected across the front by a continuous arcade. The Spanish Mission style seems naturally called for, as an expression of the constructive idea imposed by the use of concrete; and the position of the various halls is indicated on the facade by low pitched gables, characteristic of that style. The connecting links are simply roofed with cement tiles, cast in the Spanish pattern, and will form an agreeable color contrast. The construction from foundation to piers is to be entirely of concrete, and the more ornamental parts and mouldings being of artificial stone, composed of Portland cement. The chief constructive parts are the beams supporting the roof. These have a span of thirty feet, and are designed to be cast on the ground, and erected in the same manner as steel or wooden beams for the same purpose. These beams will, of course, be reinforced by steel rods, as indeed will be portions of the walls and piers; and the whole construction is expected to afford an interesting exhibition of what is sometimes popularly referred to as "poured building."

In the rear space, between the building proper and the beginning of the "Outside Mining Exhibit," granitoid platforms will be erected, on which machines used in concrete construction, and forms of concrete construction, suitable for outdoor exhibit, will be shown. The center hall will be used for showing exhibits of cement in all stages of manufacture, together with a display of drawings, photographs, etc., of Portland cement plants, including interiors, quarries, and cement and concrete work, both completed and in process of construction. The smaller hall, at the extreme right of the arcade, will be used for a complete testing laboratory, with necessary apparatus, under the charge of a competent engineer. The corresponding hall on the left, it is proposed to reserve as a meeting place for engineers, architects, contractors, etc., in fact for any and all who are interested in cement and concrete construction. Here awaken still greater interest in cement as the building material of the age.

Cement Paving Brick.

The commission in charge of the River Vistula, in Germany, has for a long time occupied itself with the production of artificial stone. This was due to the considerable increase in price of natural stone. In addition to this, work had to be found for a number of men during the periods of high water of the river. As a result of numerous experiments the following conclusions have been arrived at: For the materials, only clean, dry, sharp sand or gravel should be used. For binding material a slow setting cement, stored in barrels, must be employed. The cement must be freshly prepared. The proportions are: One part of cement to six or seven parts of sand, according to the size of the grains. When gravel is used the proportions are changed to the extent that one part of cement is used for five parts of sand and two of gravel. In the preparation the materials must be mixed dry, this is followed by slowly adding from thirty to thirty-three gallons of water to the cubic yard of dry material, taking care that the water is thoroughly and equally distributed. When the molds are filled the material is tamped until water appears on the surface. After the material is well tamped the upper surface is struck smooth and the mold is lifted off and the surfaces and corners smoothed. While the piece is hardening it must be kept wet the whole time and this hardening period must be at least of four weeks' duration. No piece may be taken for use in less than four weeks and it is desirable that the artificial stone should be allowed to set through the winter before using. The place where the work is carried on should be level and lie high and so large that there is room enough for the year's supply for one district. The most suitable ground for this is a turf, a fat clay, or a damp sandy soil. The size of the stone should be kept as closely as possible to 15¾x15¾x9⅞ in. The molds must be quite stiff, there must not be any possibility of any of the parts bending or spreading while the material

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ORGANIZATIONS AND INDIVIDUALS

The Engineering Building—The Electric Club—Good Roads Convention—International Engineering Congress—Civic Week at the St. Louis Exposition—Civil Service Examinations—Technical Meetings—Personal Notes.

The Engineering Building.

The offer of Mr. Andrew Carnegie to donate $1,500,000 for the erection of a union engineering building has been accepted by all the national engineering societies and the Engineers' Club of New York City, with the exception of the American Society of Civil Engineers. The total amount involved in the undertaking will reach $2,500,000. In addition to the sum given by Mr. Carnegie more than $500,000 represents the investment in land for the three societies, and the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the American Institute of Mining Engineers, in W. Thirty-ninth street, between Fifth and Sixth avenues, while the Engineers' Club has acquired land in W. Fortieth street, facing the new Public Library, now in course of construction.

The Electric Club.

The Electric Club of Pittsburg, Pa., is now about two years old and has over five hundred members drawn from the group of electric industries near Wilkinsburg. It holds many meetings, and lectures are given in the club's assembly-room as often as once or twice a week. The club has started a monthly journal to print the best of the current work and other appropriate electrical literature.

Good Roads Convention.

"Transportation;" Senator Lattimer, of South Carolina, upon the good roads bill of which he has charge in the Senate; Frank Z. Wilcox, of Syracuse, N. Y., on the necessity of national aid; Frank D. Lyon, special examiner of highways, on the construction of State aid roads in New York; Joseph W. Hunter, State Highway Commissioner, on the methods of operation in Pennsylvania; Col. W. L. Dickinson, president of the Connecticut Valley Highway Association, on "Continuous Lines of Improved Inter-State Roads Built by the Co-Operation of the National and State Governments with the Counties, Cities and Towns."

The International Engineering Congress.

The International Engineering Congress will be held Oct. 3 to 8, 1904, under the auspices of the American Society of Civil Engineers in conjunction with the Louisiana Purchase Exposition at St. Louis, Mo. Charles Warren Hunt, 220 W. Fifty-seventh-st., New York City, is the secretary of the committee in charge. A series of thirty-three subjects with many additional subdivisions is given as covering the ground to be considered during the week and memberships in the Congress at $5. Early application for membership is desirable that all announcements and programs may be received.

Papers from the standpoint of American Practice have already been assured on the various subjects as follows:

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Naval Architecture—By Rear Admiral W. L. Capps, Chief Constructor, U. S. N.

Dry Docks—By Rear Admiral M. T. Endicott, Chief of Bureau of Yards and Docks, U. S. N.

Traffic on Improved Waterways, etc.—By Edward P. North, New York City.

Purification of Water for Domestic Use—By Allen Hazen, New York City.

Purification of Water for the Production of Steam—By J. O. Handy, Pittsburg, Pa.

Turbines and Water Wheels—By Prof. Gardner S. Williams, Ithaca, N. Y.

Irrigation—By Elwood Mead, Chf. Irrigation Investigations, Washington, D. C.

Railroad Terminals—By Elmer L. Corthell, New York City.

Underground Railways—By William Barclay Parsons, New York City.

Locomotives and Other Rolling Stock—By George Gibbs, New York City.

Live Loads for Railroad Bridges—By Henry W. Hodge, New York City.

The Substitution of Electricity for Steam as a Motive Power—By James G. White, New York City.

Sewage Disposal—By George W. Fuller, New York City.

Disposal of Municipal Refuse—By Rudolph Hering, New York City.

Ventilation of Tunnels—By Charles S. Churchill, Chief Engineer, Norfolk & Western Railroad, Roanoke, Va.

Highways—By James Owen, Newark, N. J., and William E. McClintock, Boston, Mass.

Concrete and Concrete-Steel—By Edwin Thacher, New York City.

Deep Foundations—By John F. O'Rourke, New York City.

The Manufacture of Steel—By William Metcalf, Pittsburg, Pa.

Tests of Materials of Construction—By William R. Webster, Philadelphia, Pa.

Passenger Elevators—By Thomas E. Brown, New York City.

Pumping Machinery—By Irving H. Reynolds, Youngstown, O.

Dredges: Their Construction and Performance—By A. W. Robinson, Montreal, Can., and F. B. Maltby, Memphis, Tenn.

Electrical Power-Generating Stations and Transmission—By L. B. Stillwell, New York City.

Engineering Education—By Prof. Robert Fletcher, Hanover, N. H., and Prof. Calvin M. Woodward, St. Louis, Mo.

Wharves and Piers—By John A. Bensel, New York City.

Civic Week at the St. Louis Exposition.

A feature of the program for "Civic Week" at the Louisiana Purchase Exposition is the program giving the objects and aims and the progress made toward attaining them, of the various national societies devoted to civic improvement. The American Society of Municipal Improvements will be represented on the program by Charles Carroll Brown, member Am. Soc. C. E., editor Municipal Engineering, Indianapolis, second vice-president; the American League for Civic Improvement by Professor Charles Zueblin of the University of Chicago; the American Park and Outdoor Art Association by Charles Mulford Robinson of Rochester, N. Y., secretary; the National Municipal League by Clinton Rogers Woodruff of Philadelphia, secretary; the American Institute of Social Service by Dr. Josiah Strong of New York, president, and the League of American Municipalities by John M. Head, mayor of Nashville, Tenn.

In addition to these subjects, Professor Samuel E. Sparling of the Wisconsin State University will discuss the municipal or civic problem from the political point of view, Dr. Frank Mason North of New York from a religious point of view, and Amasa M. Eaton of Providence, R. I., from a legal point of view. Other papers prepared from administrative, improvement and sociological points of view are expected. The full program will be issued at an early date.

The sessions will doubtless be held in one of the halls in the "Model Street," the success of which seems now to be assured.

Civil Service Examinations.

The United States Civil Service Commission, Washington, D. C., will hold an examination April 19 and 20 at the usual places in the various States for heating and ventilating draftsmen in the office of the supervising architect of the Treasury Department at $1,200 a year; also for architectural draftsmen at $1,500 and a writer of specifications and computer at $1,200 in the department of the quartermaster at large in Washington.

Technical Meetings.

The New England Water Works Association held a meeting at Tremont Temple, Boston, March 9. A paper on "Experiences" was read by Charles H. Eglee. It treated of hydraulic engineering. Freeman C. Coffin opened a topical discussion on "Rates for Metered Water" and Edward H. Cowan, superintendent of water works at Marion, O., spoke on "The Detection and Prevention of Water Waste."

The eighth annual convention of the League of American Municipalities will be held in East St. Louis, Ill., Oct. 4, 5 and 6.

The eighth annual convention of the

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Minnesota Engineers' and Surveyors' Association was held in St. Paul Dec. 24. Among the papers read were the following: "Good Roads," Prof. W. R. Hoag of the State University; "Sewage Question in Cities," Dr. H. M. Bracken of the State Board of Health; "The Position of County Surveyors from the Standpoint of an Editor," Israel A. Herrick of Farmington.

The Association of Portland Cement Manufacturers held a quarterly meeting March 8 at the Hotel Walton, Philadelphia. In the absence of President J. B. Lober, Vice-President A. F. Gerstell occupied the chair. The fire-resisting power of concrete and steel as distinguished from hollow tile and steel construction was discussed at length. Special reference was made to buildings in the Baltimore fire that withstood the flames because they had been built of concrete and steel. The necessity of an impartial investigation of the matter was urged. Among the papers read were the following: "Grinding," George W. Frazier of the Kent Mill Company; "The German Cement Manufacturers' Association," S. B. Newberry of the Sandusky Portland Cement Company. On the evening of March 9 Robert W. Lesley, former president, gave a dinner to the association at his country place, "Lesselyn," Haverford, where a paper was read by Prof. J. W. Richards of Lehigh University on "Cement Burning." A silver loving cup was presented to Mr. Lesley by his fellow associates.

The Indianapolis Technical Club has been organized by the civil, mechanical, electrical and mining engineers, architects, managers and superintendents of railroads, mills and manufactories and chemists of the city, and promises to be a permanent feature of the technical progress of the city. Meetings are held on the second and fourth Saturdays of each month. Charles Carroll Brown, C. E., is president; Walter Buehler, assistant city engineer, is corresponding secretaary, and Harry B. Marsh, E. E., is recording secretary.

Personal Notes.

A. M. Owens, former mayor of Enterprise, Ala., has been elected to that office

George Ellis has been appointed superintendent of the municipal water works system at Canandaigua, N. Y.

William R. Ryon, local manager of the Barber Asphalt Paving Company at Peoria, Ill., died March 10, aged forty-two years.

George H. Reynolds of Marshfield, Wis.; J. P. Malock of Stevens Point, and G. C. Knotter of Dancy have been appointed drainage commissioners.

City engineers have been elected and re-elected as follows: A. B. Stevens, Jackson, Mich.; H. J. Harder, Paterson, N. J.; D. F. A. Wheelock, Warren, Pa.; George W. Sykes, Beaumont, Tex.

Winslow Herschel, recently connected with the engineering work at Jerome Park reservoir, New York, has sailed for Europe and will act as local agent and technical correspondent of the Allis-Chalmers Co. at Zurich.

Charles Allis has resigned as president of the Allis-Chalmers Co. on account of the ill health of his wife, which necessitates a trip abroad. He will be succeeded by B. H. Warren, formerly vice-president and general manager of the Westinghouse Electric and Manufacturing Co.

Edward J. Johnson, who has been manager and superintendent of the Sharon & South Sharon Water-works Company for twenty years, at Sharon, Pa., has resigned his position to take effect April 1, and with several practical men is going into business as the Water-works Construction Company, with headquarters at 331 Fourth-ave., Pittsburg, Pa.

Mayors have been elected as follows: William B. Skelton, Lewiston, Me.; A. Q. Miller, Auburn, Me.; Cyrus W. Davis Waterville, Me.; Luther B. Moore, Saco, Me.; James E. Rhodes, Rockland Me.; Alex. C. Haggerthy, Ellsworth, Me.; John H. McFaul, Eastport, Me.; Edward W. Hyde, Bath, Me.; George T. Spear, South Portland, Me.; Edwin L. Russell, Gardiner, Me.; J. W. Fuller, Hallowell, Me.

The Hon. William R. Grace, former mayor of New York City, died March 21 of pneumonia, aged seventy-two years. He was twice elected mayor, in 1880 and in 1884. He was also president or vice-president of numerous corporations, was director in the Lincoln National Bank, the New York Life Insurance Company, the New York & Pacific Steamship Company, which line he established in 1881, in the Brooklyn Warehouse and Storage Company and in the Lincoln Safe Deposit Company.

Village presidents have been elected as follows: George D. Clarke, Vassar, Mich.; Ananias Pouch, St. Johns, Mich.; F. H. Oliver, Allegan, Mich.; M. M. Christie, Capac, Mich.; John R. Cotten, Essexville,

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MUNICIPAL AND TECHNICAL LITERATURE

Directory of American Cement Industries—Municipal Reports.

The Directory of American Cement Industries.

The third edition of the "Directory of American Cement Industries" is now passing through the press as rapidly as the printer can be pushed on with the work and will be issued at an early day. The failure of the printer to keep his promises for definite dates makes it advisable not to set the date exactly, but there seems now to be nothing in the way of early publication. As has already been stated, the enormous expansion in the cement trade has vastly increased the labor upon all sections of the directory. This begins with the description of cement plants, nearly every one of those of the second edition being rewritten to bring in the many changes in established factories, and the number of new descriptions equalling the number printed in the first edition. The verification of thousands of new names and the determination of credit ratings for them has also taken much more time than was expected. All the delay of publication beyond the date first set cannot be attributed to the printer, therefore. It is certain that the greater accuracy in the directory and the greater fullness of the lists will amply compensate for the comparatively short delay in publication, and the lists will appear, fresh and complete, in plenty of time for use in the season's trade.

Municipal Reports.

Report of the Chief Engineer of the Board of Estimate and Apportionment of the City of New York, 1902 and 1903. Nelson P. Lewis, Chief Engineer.

This is the first report of this official, the office having been established Jan. 1, 1902, under the revision of the city charter. The report is unique in at least one respect, in that it contains no names of officials other than Mayor George B. McClellan in the address and Chief Engineer Nelson P. Lewis in the signature to the report.

The board and its engineer must pass upon all the projects for municipal improvements in the city. The extent of its responsibilities may be gauged by the number and cost of improvements considered. In 1903 assessable improvements authorized were 435 with an estimated cost of $6,989,000. Brooklyn presented nearly half of the total and Bronx borough more than one-third. The total cost of improvements in 1902 was about the same, though the number was less. The proportion in the various boroughs was approximately the same.

The report treats somewhat at length of the various pavements used and offered, the improvements desired before the 300th anniversary of discovery of the Hudson river, and the activities of the various boroughs, thus giving a very valuable birdseye view of the march of improvement in all parts of the great city. New parks, bridge approaches and improved railroad terminals are the great questions considered in the report.

Full tables give the most prominent data regarding the improvements presented for consideration and the action taken thereon.

Seventh Annual Report of the Board of Trustees, Commissioners of Waterworks, Cincinnati, O., 1903. Aug. Herrmann, Pres.; G. Bouscaren, Chief Engr.

The receipts during the year were $1,717,000, all but about $200,000, being the proceeds of a bond issue. The expenditures were $1,128,455. Thus far $4,079,067 has been spent upon the construction of the new waterworks, including all expenses, interest, administration, etc. The expenditures are classified under 21 items, the principal of which are the California pumping station, $900,000; the gravity conduits, $887,000; engineering, $447,000; settling basins, $375,694; Pendleton pumping station, $332,000. The work is not yet half completed, the total estimated cost being $9,500,000.

The Chief Engineer's report gives details of the three contracts let during the year, amounting to $583,878. These contracts were for the buildings and

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chimneys of the western pumping station, coal storage houses and a small contract for piling and bank protection. Progress reports are made on the contracts in hand and on those completed during the year. A report from the chief and consulting engineers on the variation in position of the floor of the pump pit with change in level of the river is given. Weight of pumps and control of water pressure by pumping out during highest floods are to be depended upon to keep the floor in place.

Statistical tables give details of contracts and expenditures.

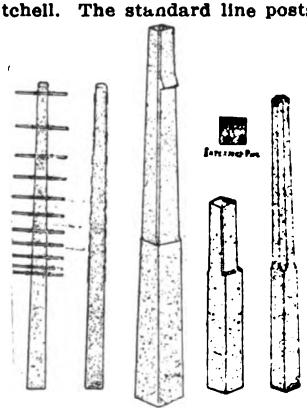
Annual Report of the City Engineer, Cambridge, Mass., Nov. 30, 1903. James Wilson Pierce, City Engineer.

Mr. Pierce was city engineer for half the period covered by the report, L. M. Hastings being his predecessor. Sewers 2.7 miles long were built at a cost of $74,497, not including catch basins. The city engineer's department cost $9,200; sewer maintenance, $18,000; dredging, $2,672. The street work seems to have been done by day labor under the street department, 3,330 square yards of brick pavement and 625 square yards of granite block being reported, without figures of cost, in the city engineer's report.

MACHINERY AND TRADE

The Post Question.

The Hillsdale Fence and Post Company of Hillsdale, Mich., believes that it has solved the fence post problem in the reinforced concrete post invented by J. A. Mitchell. The standard line posts are



FORMS OF MITCHELL'S CONCRETE FENCE POSTS.

3½x5 inches at the bottom and 2½x3 when resting on supports about 6 feet apart. The drawing shows the regular line post, corner post, bracing post, a special octagonal post and a cross section of a post.

Mr. Mitchell has also invented a very simple machine for making hollow concrete building blocks 8x9x18 inches in dimensions, and with a hollow 3x12 inches.

The Bitulithic Pavement at Cohoes, N. Y.

The Warren Brothers' Company have been awarded a contract in Cohoes, N. Y., for 22,000 square yards of their patented Bitulithic pavement at $2.48 per square yard, the pavement to be laid in Ontario, Vliet and Mangan-sts.

When the asphalt promoters found there was no hope for the success of their material they turned the full force of their strength and influence in favor of brick. The East Side Taxpayers' Assso-

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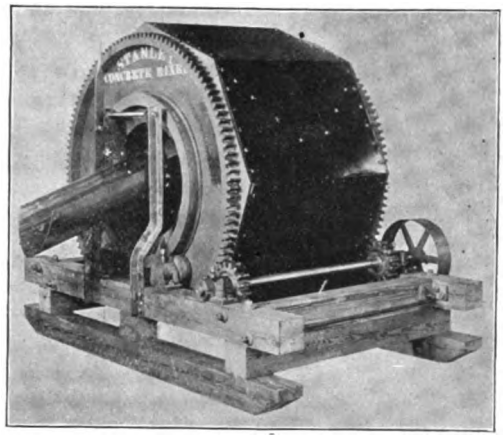
but because the Bitulithic paving was the choice of the taxpayers after a thorough investigation of its merits. The accompanying petition for Ontario-st. contained the names of all but two of the property-owners liable to assessment for the improvement of that street.

Another System of Hollow Concrete Blocks.

The molds manufactured by the Michigan Cement Block Machinery Company were gradually developed in a yard devoted to the manufacture of concrete block. They are the product of practical experience gained in the making of concrete blocks. They do not represent any theories or whims, but are useful only for the purpose for which they are made. The size of block they make, 18x8x9 inches, less ⅜ inch for a mortar joint, combines many good features. This block lays one square foot of nine-inch wall. The number of square feet in the walls of a building give the number of blocks required. This size readily subdivides into half or quarter blocks. As the dimensions of buildings are generally in feet or fractions thereof, the puzzling combinations of blocks containing more or less than a square foot are avoided. The weight of this block, about 50 pounds for plain or sixty for rock face, is as great as one man can manufacture unaided, or a man lay in the wall without a tender.

In many cases the gain made in surface on a large block is lost in the cost of making alone, to say nothing of the increased cost in laying.

The loss in the breakage of blocks in making is one of the worst leaks in the successful manufacture of the hollow block. Thousands of blocks have been made in this mold in the last three years with a breakage loss of less than 3 per cent. This is one of the most valuable features of the system. Blocks made from these molds are in general use in Michigan, one large cement mill having used 5,000 in the past year. Machine shops, boiler rooms, elevator walls, churches, houses, stores, woodsheds, coal houses, ice houses, sheds, hen houses, and other buildings have been thoroughly tested and tried before being placed upon the market.



PRISMATIC DRUM CONCRETE MIXER.

The Stanley Concrete Mixer.

The accompanying photograph shows the discharge end of the Stanley prismatic drum concrete mixer, which was described on page 209 of the March number of Municipal Engineering, and will aid in making clear the method of operation of the machine.

The material is dumped into the machine from barrows at the other end. The chute shown in the picture is tipped up into a position to retain the materials in the mixture while the machine is revolved. When the concrete is thoroughly mixed a lever is thrown which drops the chute into the position shown. It then receives the concrete from the revolving drum as it comes to the upper end of the chute, and discharges it into a barrow or a pile outside.

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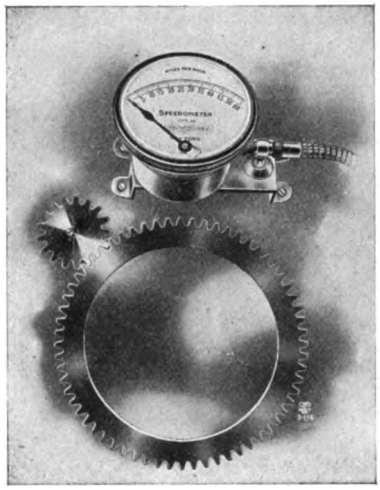
The machine is shown to be an octagonal prism, not a cylinder. Deflector plates on the inside of the plates of the drum throw the mass of concrete from side to side so that it receives a double turning, equivalent to that in a cubical box swung from two opposite corners.

How Fast Was That Auto Traveling?

The accompanying cut illustrates 36 men from the Washington, D. C., bicycle force —just one-half the squad. Each man's machine is equipped with a Jones Speedometer, which is fitted to the front fork of the bicycle by means of a supporting clamp.



GEAR DRIVE SPEEDOMETER FOR AUTOMOBILE.

Realizing the necessity for an instrument which would tell the policeman the exact speed in miles per hour which he is traveling, as he flies after an offender of the speed law, Major Sylvester adopted the Jones Speedometer in which guesswork is eliminated, since the rider can tell at a glance the speed of any moving vehicle.

Major Sylvester expresses his entire satisfaction with the instrument in a letter to the company manufacturing it.

While this instrument is as necessary displaying a new device—a gear-drive attachment. The large gear is attached to the front wheel of the car with screws. A smaller gear is carried by a ball-bearing shaft supported on the steering arm by means of an attaching clamp. The speedometer proper is attached to the dashboard of the car in any convenient position, and is connected with the drive gear on the wheel by means of a flexible shaft.

The small gear-shaft support is provided with a swivel base which permits the gears to separate in the event of any obstacle, such as a stone, getting caught in the teeth, thereby preventing any damage to the gears.

Two sizes of this instrument are made, with indicating dials three and four inches in diameter.

This system of gearing makes an absolutely positive drive, and is very durable. By a series of different gears the speedometer may be adapted to any standard wheel from twenty-eight to thirty-six inches in diameter. The change can be made by simply removing a cotter pin and changing the smaller gear for one of different diameter and number of teeth. The advantage of this is obvious, as any dealer carrying a speedometer in stock can, with an extra set of small gears, fit the speedometer to any size wheel, or the owner of an automobile can, by securing a new gear use the same speedometer on different cars.

The speedometer is manufactured by Joseph W. Jones, 127 W. Thirty-second-st., New York.

The Penn-Allen Plant in Operation.

The Penn-Allen Portland Cement Company, of Allentown, Pa., are issuing notices that they have been in operation for several weeks and are beginning to ship cement.

The works of the Penn-Allen Cement Company are situated at Penn-Allen, near Nazareth, Pa., on the tracks of the Lehigh and New England Railroad Company, and are said to be a model plant with a capacity of 1,000 barrels per day, but the mills were originally designed

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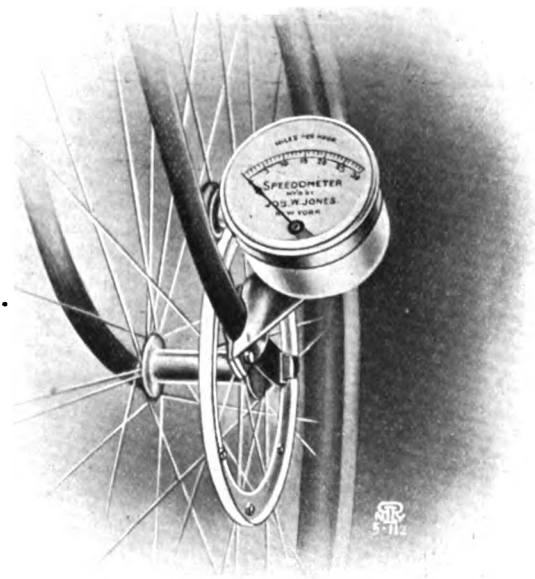

SPEEDOMETER ON BICYCLE.

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One interesting feature of this new plant is the installation of eighty-foot kilns, which have turned out so successfully that several other mills in the Lehigh region are installing them.

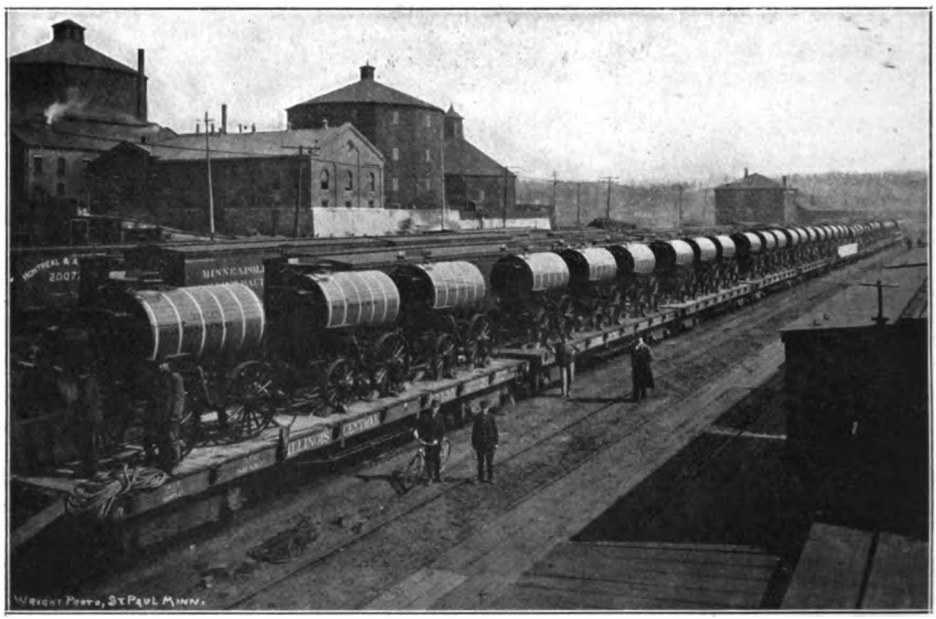
The general offices are at Allentown, Pa., from which place all transactions will be conducted. J. Maxwell Carrere is the general manager.

A Large Shipment of Street Sprinklers.

That street sprinkling wagons have become an essential part of every city's equipment is not denied. They are no longer considered a luxury, the conveniences of which are to be enjoyed only by the more prosperous class of citizens, but a necessity from a sanitary as well as an economical point of view. In the

lers, insisting upon their use as a preventive of the spread of disease.

The Austin street sprinkler, manufactured by the Austin Manufacturing Company of Chicago, is one of the best known and most popular machines of this description on the market, and has attained that position through its merits. It is a simple device, but strong and efficient, and is used by a large number of important cities. The accompanying photograph shows a shipment of these sprinklers made to the city of St. Paul, Minn., a single purchase of magnitude



A LARGE SHIPMENT OF SPRINKLERS,
Made by Austin Western Co. to St. Paul, Minn.

sufficient to show the confidence of the city authorities in the efficiency of the apparatus.

The United States government uses the Austin sprinklers in Yellowstone Park

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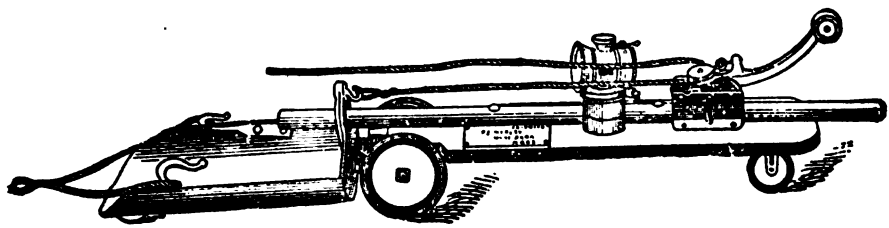
cleaning has been a subject that has occupied the attention of many of the most prominent engineers in the country. It has been brought before the various engineering societies and has been subject to careful consideration from these bodies.

An invention owned and patented by Mr. P. J. Healey of 10 Tremont-st., Boston, has concentrated the attention of the foremost engineers, who have made the subject of sewer cleaning a specialty, and it appears to have their unqualified indorsement.

At a recent meeting of the Boston members of the American Society of Civil Engineers in Boston, Mr. R. S. Door, C. E., chief of the Bureau of Sewers, gave an interesting lecture on this device, using a model in illustrating his remarks. The subject being worthy of more than passing notice, a representative of Municipal Engineering Magazine called on Mr. Door, who stated that he had, as head of the department, watched the work of the machine, which had been adopted after several preliminary trials. The tests were of a very severe nature and had been succesful in cleaning sewers that previous to the Healey invention had to be ripped up. These were twelve and eighteen-inch size and presented a serious problem to the department. As evidence of the rapidity with which this machine can be worked and its general effectiveness, it can be stated that at a demonstration on Union-ave., Brooklyn, on March 14 of last year, there were removed from a three-foot sewer 108 pails of sediment in two hours and a quarter, or at the rate of four pailfuls in five minutes, the dispraise, Mr. Healey having received the personal indorsements of such as Mr. John Thatcher, Supt. of Sewers, Brooklyn, N. Y.; Mr. Matthew J. Kennedy, Supt. of Maintenance, Brooklyn, N. Y.; Mr. Theodore L. Pike, Supt. of Sewers, City of Cambridge, Mass.; Laforest Beals, Supt. of Streets, Lowell, Mass.; N. K. Thompson, Street Commissioner, Elizabeth, N. J. It has been approved by the officials of the Bureau of Streets and Sewers in Boston and many others.

Mr. Healey is a practical sewerage man, having been foreman with the Metropolitan Sewer Commission of Boston for ten years, and for three years with Sewer Cleaning Department, also of Boston. It was while in this capacity that the inventive genius of the patentee developed, and after many years' study he evolved the present patent.



THE HEALEY SEWER CLEANING MACHINE.

Trade Publications.

Electric coal mining plant and storage battery industrial locomotives are described and illustrated in bulletins 4 and 5 of the Jeffrey Manufacturing Company, Columbus, O. This series of bulletins are of the standard size, 7 by 10 inches, and perforated for insertion in a handy binder.

The special catalogue for 1904 of the Aultman Company, Canton, O., gives the details of their double star traction engine, showing its simplicity and strength.

Baldwin, Tuthill & Bolton, Grand Rapids, Mich., send a 200-page catalogue for 1904 of saw and knife fitting machinery and tools, saw-mill and woodworking machinery, of which they have printed 40,000 copies.

Asphalt, concrete and pitch paving tools

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their alternating current machinery for lighting, power and railway service.

List No. 2 of the Railway and Electric Equipment Company gives lists of their electrical machinery for trolley roads and for lighting and their railway equipment for steam roads, etc. The company has offices in Philadelphia, Buffalo, Chicago, Pittsburg and Cleveland.

The Kent Mill Company, 170 Broadway, New York City, sends a calendar advertising its machine for grinding cement clinker, quartz, limestone, phosphate rock and other hard substances.

Pettijohn Brothers, 1300 N. First-st., Terre Haute, issue a circular descriptive of their machine for making hollow concrete building blocks and the method of operating it, giving also the cost of the machines and of making blocks with them.

Trade Notes.

ASPHALT.

The Dunderberg Asphalt Company, Jones Point, N. Y., has been incorporated by L. C. and L. I. Gillespie, of Morristown, N. J., and J. T. Gillespie, of New York City.

The American Asphalt-Mastic Company, with headquarters at Detroit, Mich., has been incorporated to "manufacture and sell asphalt-mastic or a composition for paving and roofing consisting of asphaltum and lime sludge from purification of beet juice in sugar manufacture." The incorporators are Ammi W. Wright, Alma, Mich.; F. R. Hathaway, Roderick, A. Gurley, Denver, Colo.; Wm. H. Worswick, San Francisco, Cal. The first plant will be built at Alma.

The Walnut Creek Oil and Asphalt Company, Austin, Tex., has been organized to develop asphalt property.

A deposit of asphalt rock on the island of Bahrein, in the Red Sea, is being investigated by the British authorities. Laboratory tests prove it to be satisfactory for paving purposes, showing that the material can be diluted up to 75 per cent. with limestone. The asphalt is too low in grade, however, to be profitably exported to European markets, but it is thought that it can be sold in India at a price which would make its shipment there practicable.

The Barber Asphalt Paving Company will build a stone crushing plant on a site on the East Side known as the Lowery tract, at Minneapolis.

The Wadsworth Stone and Paving Company recently closed contracts for a clay drying plant for the Delaware Clay Manufacturing Co., of Delaware, O.; plant for the drying of waste phosphates for the Grasselli Chemical Co., of Tremley, N. J.; an installation for the drying of tobacco stems for the Henderson Tobacco Extract Works, of Henderson, Ky. The company is also installing a shale drying plant for the Elko Paint Co., at Randolph, N. Y.

The board of public works at Peoria, Ill., advocates the establishment of paving brick plant.

W. F. Brennah, deputy commissioner of public works at Chicago, resigned his position March 1 and accepted that of Western agent for the Metropolitan Paving Brick Company, with plants at Canton and Cleveland, O.

The Vitrified Brick Company of Boise, Idaho, has let contracts for additional burning kilns, and will double the present capacity of its plant.

CEMENT.

The Newaygo Portland Cement Co., Newaygo, Mich., has established a general sales office in the Michigan Trust Company Bldg., Grand Rapids, Mich., in charge of George T. Burridge as general sales agent. The company requests that, in order to facilitate the handling of mail and insure prompt filling of orders, that all orders for cement, as well as all correspondence regarding prices and freight rates, be addressed to Newaygo Portland Cement Co., Michigan Trust Co. Bldg., Grand Rapids, Mich., where they will receive prompt acknowledgement and attention.

The Western Portland Cement Works Co. is enlarging its plant at Yankton, S. D.

According to press reports of March 16 a new company is being organized at Carthage, Mo., to manufacture a paving cement from mine tailings. It is not yet known who is at the head of the project.

Henry Wood Bergen of Jackson, Mich., cement expert and chemist for the Peninsular Portland Cement Co., has found, according to local press reports, that the marl deposits in Bass, Zukey and Island Lakes, near Lakeland, are as rich as any yet discovered in Michigan.

The Cairo Sand, Lime and Cement Co., Cairo, Ill., has been incorporated to deal in building materials, by F. J. Fitzgerald, E. A. Patier and E. P. Fitzgerald.

The Pennville Concrete Co., Pennville, Ind., has been incorporated by Elza N. Cary, C. E. Caylor, M. G. McCarty, L. G. Walling and William C. Waltz.

The cement works at Syracuse, Ind.,

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been investigating the field in Clarke County, Alabama, with a view to ascertaining conditions and advantages for establishing a cement plant.

The plan for the reorganization of the Hecla Portland Cement and Coal Company at Bay City, Mich., has been submitted to the stockholders. It provides for the formation of a new company with a capital of $1,000,000.

The Belleville Portland Cement Company, Belleville, Ont., has placed orders for steam turbines for operating its cement works.

The Columbus Cement Company, Columbus, O., has been incorporated by John Albert Jones, William H. Phillips, John C. Sherwood, Walter Page, Jr., and John P. Given.

The quarry property of the Michigan Alkali Company, at Bellevue, Eaton County, Michigan, has been purchased by the Hon. Wellington R. Burt and George R. Burt and an immense Portland cement plant will be built.

The Terrace Park Concrete Company, Cincinnati, O., has been incorporated by J. E. Bellville, C. V. McChesney, L. A. Walton, William Lamb and W. A. Seward.

The Bronson Portland Cement Company has purchased 500 acres of valuable marl beds near Schoolcraft, Mich.

The Alsen American Portland Cement Company announces that the firm of Sinclair & Babson has withdrawn from the company's selling agency and that this business will hereafter be conducted exactly as heretofore, including the importation and distribution of the German Alsen, by the Alsen Portland Cement Works, at 45 Broadway, New York City. W. P. Corbett, Secy. and Gen. Mgr.

The Diamond Portland Cement Company, Lincoln, N. J., has been incorporated to manufacture cement by Edgar Granert, Max F. Wirtz and Carrie C. Wirtz.

Messrs. Sinclair and Babson having withdrawn as the selling agents for the Alsen American Portland Cement works, the business will hereafter be conducted directly by the company. Mr. W. P. Corbett is now secretary of the Alsen Company and General Manager of Sales. He has taken charge of same with offices as heretofore, 45 Broadway, N. W. Business will be conducted as before and those having previous dealings with that company, will find Mr. Corbett in every way up to the usual "Alsen standard" in hospitality and businesslike qualifications.

CONCRETE BLOCKS.

The Contractors' Tool Company, 704 Arch-st., Philadelphia, Pa., advises us that it is issuing a new catalogue of asphalt and roofers' tools and machines, and also one for cement pavers.

The Brady Cement Stone Machine Company of Jackson, Mich., contemplates building a large plant at Louisville, Ky., for manufacturing cement building blocks.

The Columbus Cement Stone Company, Columbus, O., has been incorporated by John Albert Jones, William H. Phillips, John C. Sherwood, Walter Page, jr., and John P. Given. The company will manufacture cement stone for all purposes.

The Fond du Lac Cement Brick Manufacturing Company has been incorporated at Fond du Lac, Wis., by A. C. Dallman, Joseph Hutter, John Hutter and E. F. Cooper.

The plant of the Perth Amboy Cement, Stone & Roof Tile Company, Perth Amboy, N. J., is to be greatly enlarged and improved. C. C. Christensen is president, George W. Yepsen secretary and A. Hansen treasurer.

The Rock County Concrete Stone Company, Janesville, Wis., has been organized to manufacture building materials from cement by Grant U. Fisher, Evan D. Roberts and Frank J. Mouat.

The Freeport Concrete Construction Company, Freeport, Ill., has been incorporated.

The Medina Concrete Company, Medina. O., has been incorporated to manufacture concrete building blocks, by B. Felton, Clare R. Warner and Walter Kennedy.

The Lansing Artificial Stone Company, Lansing, Mich., has been organized to manufacture cement brick.

I. L. Shaw of Gibson, Ill., has invented a machine for molding concrete building blocks.

The citizens of Liverpool, O., are interested in a proposition to establish a plant in the East End for manufacturing cement building blocks. John Scott and Prof. R. E. Rayman are interested.

A company is being formed at Detroit, Mich., to erect a number of plants throughout the States of Michigan and Ohio for the manufacture of cement brick.

The establishment of a plant at Glassboro, N. J., for the manufacture of cement building blocks is contemplated.

F. M. Johnson, of Minneapolis, and L. Hallum will establish a plant at Fosston, Minn., this spring to manufacture cement sidewalk blocks.

A plant for the manufacture of cement blocks and walks is proposed at Grand Island, Neb.

The Pressed Stone Manufacturing Company, recently incorporated at St. Paul by George W. Oaks, W. S. Darby, B. S. Oaks and others with a capital of $50,000, have closed a contract whereby they secure a complete power equipment for the manufacture of the Miracle Hollow Concrete Blocks, which will be installed in St. Paul, on the ground they have secured on the C., St. P., M. & O. right of way, on the West Side. They will also control the sale of these machines and the product, under the Miracle patents, in all the southern part of Minnesota, except a few counties in the immediate vicinity of Minneapolis, which have been reserved for Minneapolis territory.

J. O. Waterworth of Waterworth & Fee, of Duluth, Minn., has purchased an out-

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fit for the manufacture of the Miracle Hollow Concrete Building Block, which will be installed at Duluth in a very short time. Waterworth & Fee are practical cement men, as well as heavy contractors, and are going into the business on an extensive scale.

LIGHTING AND POWER.

The Ottawa Construction Company, Toledo, O., has been incorporated to build electric light and power plants and railways, by S. W. Cook, Wm. E. Brown, Geo. W. Pearson, John Quaife, and Samuel Hourt.

The California Gas & Electric Corporation, San Francisco, Cal., purchased the Standard Electric Company of California and the United Gas & Electric Company of San Jose.

Newly incorporated electric light companies: Monroe Water and Light Company, Monroe, Wash.; Marion, Bucyrus & Tiffin Railway and Light Company, Bucyrus, O.; Carthage Heat, Light & Power Company, Carthage, Mo.; Nassau Gas, Heat and Power Company, New York City; Seaboard Gas Company, Camden, N. J.; Western Water and Power Company, Chicago, Ill.

J. C. Waugh of Moline, Ill., has been granted a patent on an acetylene gas-making machine.

The Nernst Lamp Company, of Pittsburg, Pa., has opened an office and salesroom at No. 7 W. Mohawk-st., Buffalo, N. Y., where the above mentioned company intends to carry at all times a full line of lamps and parts for the purpose of supplying the trade.

Mr. G. E. Bennett, formerly Assistant Manager of the Chicago office, has been appointed district salesmanager of the Buffalo office of the Nernst Lamp Company.

MACHINERY AND MATERIALS.

We are directly advised that the following people are interested as possible buyers of machinery and tools as follows:

C. E. Chandler, Eureka, Kas., cement block machine and small mixer.

W. J. Gilmore, Tipton, Ia., cement finishing tools.

Gray & Stewart, Portland, Ind., wheelbarrows, shovels, picks and cement finishing tools.

Allen & Allen, Washington, Ind., concrete block machine.

Salina Hydraulic Stone and Brick Company, Salina, Kas., hollow block molds.

George W. Miller, 802 Equitable Bldg., Des Moines, Ia., concrete construction machinery.

George W. Powell, box 40, Warren, Ind., machinery for brick, stone and cement work.

W. S. Haynes, of Samuel W. Black & Co., Pittsburg, Pa., concrete block machinery.

W. B. Worley, Oxford, Miss., machinery for laying concrete pavements.

J. W. Schwartz, Shenandoah, Ia., tools for paving and cement.

A. P. Deure, Corning, Ia., tools for manufacture of artificial stone, cement and lime.

J. F. Plew, Vevay, Ind., trowels, tampers, jointers, edgers and all other tools for cement work.

W. L. Harding, Charleston, Ill., band saw, paving planer and sticker.

H. C. Friend, 813 E. Lexington-ave., Ashland, Ky., tools and machinery for erection of cement houses.

E. Kenney, Creston, Ia., cement building blocks and other artificial stone.

W. F. Dallison, Bedford, Ia., cement blocks and sidewalk machinery.

J. M. King, machinery for artificial stone work.

A. H. Brown, Cresco, Ia., all kinds of cement tools.

W. H. Faulkner, Fairfield, Ia., stone crushing machinery.

John Pro, Spencer, Ia., hollow concrete block machine and sidewalk tools.

Frank Ferren, 1319 Fourteenth-st., Des Moines, Ia., finishing tools.

W. E. Junker, Princeton, Ind., cement tools.

R. B. Bonce, Great Bend, Kas., cement block machinery.

R. G. Jacobs, Flemingsburg, Ky., paving tools.

Adam Vilmes, Le Mars, Ia., cement workers' tools.

G. P. Frysberger, Bloomfield, Ia., cement building block machinery.

C. B. Millenie, Fairfield, Ia., hoisting machine and bricklayers' tools.

F. Steinhart, 209 James street, Blue Island, Ill., concrete mixer.

Springfield Hydraulic Stone Company, Springfield, Ill., gas engine and mixer.

H. O. Bench Corporation, New London, Conn., brick hand press for making face brick of cement.

Noah Bogard, 1400 E. Grove street, Washington, Ind., concrete mixer, sidewalk and curbing tools of all kinds.

Joseph Trompeter, Peru, Ill., concrete mixer, surveying instruments, tools, etc.

J. A. Thornton, Morgan City, La., engines and steel castings.

Frost & Son, Jerseyville, Ill., building block machinery.

Frank J. Rice, Norwich, Conn., hollow cement blocks, rock face, machinery.

Moran & Hardy, Lake Forest, Ill., all tools used in cement work.

A. H. Beidelman, Naperville, Ill., concrete mixer and hoisting machine.

M. F. Murphy, Normal, Ill., cement sidewalk, posts and blocks.

Lord Fuel & Ice Company, Monmouth, Ill., hollow block machine and sidewalk blocks.

John Kellie & Co., 702 Michigan-ave., Detroit, Mich., mixers.

Peter Fillion, 1519 S. I street, Bedford, Ind., concrete mixer.

Frederick S. Brown, 740 La Salle street, Chicago, Ill., concrete building block machine.

J. H. McCulloch, 1014 Marshall street, Paris, Ill., hollow block machine.

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Fuller Bros., Frostburg, Md., hoisting engines, concrete mixer, cement tools.

Gabriel A. Chamblin, 254 N. Royal street, Mobile, Ala., hoisting machine and cement tools

Joseph S. Hamilton, 605 Franklin-st., Wilmington, Del., concrete block machine, tools and forms.

E. F. Burnham, Paw Paw, Mich., block and tile machines and tools.

C. W. Sheatsley, 104 Grant-st., Niles, Mich., cement machinery.

D. W. Mellen, 22 Dwight-st., Springfield, Mass., concrete mixer.

Edward L. Suiter, 410 E. Oak-st., Fort Collins, rock crushers and concrete mixer.

E. Miller, 902 Northwestern Bldg., Minneapolis, Minn., hoisting machine and derricks.

Clarence W. Coats, 727 Wisconsin-ave., Lansing, Mich., building block machines.

C. J. Stone, Kingsbury, Cal., pumping plants.

John H. Hansen, Box 9, Wallace, Idaho, hollow concrete block machine.

Charles Vogel, Wheaton, Ill., cement block machine.

John Sweeney, Hingham Centre, Mass., all kinds of machinery for quarry and stone work.

F. W. F. Woolicott, 5 Thornton-st., Winthrop, Mass., machinery for general contracting.

B. L. Ralph, Savannah, Mo., machinery for making hollow concrete blocks.

Bagley & Bagley, Santa Rosa, Cal., concrete mixer and concrete block machine.

Congdon Construction Company, 313 Hennepin-ave., concrete mixer.

Evans Smith, Monroe City, Mo., concrete block machines.

Edward Ottoman, 306 S. Haven-st., South Haven, Mich., concrete mixer.

W. L. Bond, Monroe City, Mo., stone block machine.

C. K. Anderson, 605 Vine-st., Owatonna, Minn., hollow building cement block and sidewalk tile machinery.

J. D. O'Connell, 424 Manhattan Bldg., Duluth, Minn., grading and sewer trench machines.

We have direct advice from the following people who are interested as possible buyers of the following materials: C. E. Chandler, Eureka, Kas., cement; J. W. Schwartz, Shenandoah, Ia., cement and stone; Frank D. Burckhard, Clarinda, Ia., cement and crushed rock; J. G. Partch, Concordia, Kas., Portland cement; E. S. Bowen, Garner, Ia., lime and cement; B. F. Bell, Newcastle, Ind., street paving blocks; W. J. Gilmore, Tipton, Ia., cement; Gray & Stewart, Portland, Ind., cement; Allen & Allen, Washington, Ind., cement; George W. Miller, 802 Equitable Bldg., Des Moines, Ia., cement; George W. Powell, box 40, Warren, Ind., brick, stone and cement; Adam Jess, jr., Pennsgrove, N. J., cement in fifty-barrel lots; E. A. Randall, lock box 36, Cedar Falls, Ia., Portland cement; H. C. Friend, 813 E. Lexington-ave., Ashland, Ky., cement; E. Kenney, Creston, Ia., broken stone, gravel and cement; W. F. Dallison, Bedford, Ia., cement and brick; J. M. King, Ashland, Ky., general builder's supplies; W. H. Faulkner, Fairfield, Ia., cement and crushed stone; John Pro, Spencer, Ia., cement, lime, stone and brick; Frank Ferren, 1319 Fourteenth-st., Des Moines, Ia., cement in car lots; W. E. Junker, Princeton, Ind., lime and cement; R. B. Bonce, Great Bend, Kas., all kinds of cement; R. G. Jacobs, Flemingsburg, Ky., sand and cement; W. A. Steed, Newnan, Ga., street paving and road constructing materials; Bloomington Concrete Co., 305 W. Washington-st., Bloomington, Ill., combined curb and gutter; J. W. Clark, 915 Hester-ave., Centralia, Ill., cements and brick; John Kellie & Co., 702 Michigan-ave., Detroit, Mich., cements; J. H. McCulloch, 1014 Marshall-st., cement and sand; Fuller Bros., Frostburg, Md., cement, lime, sand, brick and stone; Gabriel A. Chamblin, 254 N. Royal st., Mobile, Ala., cements; Springfield Hydraulic Stone Co., 10 Jackson-st., Springfield, Ill., Portland cement; Noah Bogard, 1400 E. Grove-st., Washington, Ind., Portland cement and crushed granite; F. T. Hardesty, Rock Falls, Ill., stone, brick and cement; Joseph Trompeter, Peru, Ill., cement, rock, sand, gravel and brick; J. A. Thornton, Morgan City, La., gray castings; Frost & Son, Jerseyville, Ill., cement and crushed granite; J. M. Stone, Ft. Madison, Ia., cement; Moran & Hardy, Lake Forest, Ill., cement; A. H. Beidelman, Naperville, Ill., cement; M. F. Murphy, Normal, Ill., cement, stone, sand and gravel; Lord Fuel and Ice Co., Monmouth, Ill., Portland cement. Joseph Hamilton, 605 Franklin-st., Wilmington, Del., cement—C. W. Sheatsley, 104 Grant-st., Niles, Mich., cement—D. W. Fuller, 22 Dwight-st., Springfield, Mass., cement, lime and brick—E. Miller, 902 Northwestern Bldg., Minneapolis, Minn. building materials—Clarence W. Coats, 727 Wisconsin-ave., Lansing, Mich., cement—A. D. Harrison, Little Falls, Minn., cement and lime—C. J. Stone, Kingsbury, Cal., cement and brick—J. H. Hansen, box 9, Wallace, Idaho, cement—Samuel Myrtelus, Wabasha, Minn., cement—Chas. Vogel, Wheaton, Ill., cement—John Sweeney, Hingham Center, Mass., all kinds of cements, stone, rough and finishing—H. N. Cagill, 532 Ottawa-st., Grand Rapids, Mich., cement paving and general concrete work—F. W. F. Woolicott, 5 Thornton-st., Winthrop, Mass., lime, cement, brick—R. P. Burgess, 51 Auburn-st., Reading, Mass., lime, cement, etc.—B. L. Ralph, Savannah, Mo., cements—Bagley & Bagley, Santa Rosa, Cal., cement, lime, brick, plaster—Congdon Construction Co., 313 Hennepin-ave., Chicago, Ill., Portland cement in large lots—Evan Smith, Monroe City, Mo., cement—Edward Ottoman, 306 S. Haven-st., South Haven, Mich., cement, lime, brick—C. K. Anderson, 605 E. Vine-st., Owatonna, Minn., lime, cement, brick, hollow tile, and all kinds of building materials—J. D. O'Connell, 424 Manhattan Building, Minn., cement.

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MISCELLANEOUS.

The Artificial Paving Co., Syracuse, N. Y., has been incorporated to manufacture cement walks, by Wm. J. Burns, Wm. Spooner and Harry Osborne.

The Reliance Quarry & Construction Co., St. Louis, Mo., has been incorporated by Edward A. Hermann, Henry W. Hermann and Louis C. Hermann.

J. B. Duggan and others of Tacoma, Wash., are considering a plan for establishing plant to manufacture creosote paving blocks.

The Davenport Construction Co., Davenport, Ia., has been incorporated to do excavating, concreting, paving, or construction work, by C. G. Hipwell, F. H. Bartemeyer, C. C. Campbell and J. Britt.

The Concrete and Natural Stone Co., Chicago, Ill., has been organized to deal in artificial and natural stone, by James P. Grier, Wm. H. Tuttle and M. D. Cross.

The Allis-Chalmers Co., has absorbed the Bullock Electric Manufacturing Co., of Cincinnati. The business of the Bullock company will be conducted under the same management as heretofore, but under the general direction of the Allis-Chalmers company.

The Newark Artificial Stone & Plaster Co., Newark, O., has been incorporated by A. R. Pilser, Eli Hill, F. T. Mercer, John McNamara, C. E. Cochran, E. R. Hackney and B. F. McDonald.

The Jackson Cement Sewer Pipe Co., Jackson, Mich., has been incorporated, with Edward F. Lowery as president, John M. Phalen, vice-president; Andrew J. Meade, secretary and treasurer.

Recent Inventions.

730,212, June 2, 1903. Machine for Molding Building Blocks or Artificial Stone. C. H. Hutchings, Toronto, Canada. The block is made, the core to produce hollows is removed, the mold box is turned onto a removable side, and unlocked. The ends and front side of the mold box, hinged to the bottom, are turned out and up and the block is drawn out on a carriage; the apparatus is all carried on a suitable frame.

730,518. Jan. 9, 1903. Filtering System. F. A. W. Davis, Indianapolis, Ind. Impervious bottoms with depressed channels, many closely arranged transverse channels to collect filtered water, covered with from iron, with porcelain frits burned approximately to the fusing point.

730,780. June 9, 1903. Building Wall and Concrete Block for Same. O. U. Miracle and W. L. Dow, Sioux Falls, S. D. A wall built of blocks with two parallel rows of air cavities separated and surrounded by concrete, the necks between cavities being strengthened by wire cloth.

730,817. June 9, 1903. Catch-Basin. Martin Cullen, Boston, Mass. A catch-basin overflowing through trap into overflow basin and having also a drain door, tapering to open easily through the sediment in the basin and a small clean-out conduit at the bottom.

731,032. June 16, 1903. Garbage Crematory. J. A. Forsyth, Atlanta, Ga. A furnace having combustion chamber with arched roof, on which garbage is deposited, a boiler partly over the outlet of the combustion chamber and serving to deflect the gases to the garbage, also a second independent fire to help heat the boiler, gases going out in same way.

731,323. June 16, 1903. Machine for Molding Hollow Concrete Building Blocks. Harmon S. Palmer, Washington, D. C. An addition to the removable bottom plate of the Palmer machine, when width of blocks is increased, of an auxiliary filling-strip having webs or ribs for filling the spaces, also of strip for forming a water table on the block, of removable division plates for molding slabs, nested cores, improved core carrier, etc.

731,346. June 16, 1903. Water Purifier. Elvi Delmonly, Paris, France. Water tank with two measuring compartments alternately delivering to mixing tank by means of an oscillatory double water wheel, and a chemical distributor operated by each discharge.

731,468. June 23, 1903. Apparatus for Softening or Otherwise Chemically Treating, Filtering and Storing Water. F. B. Leopold, Cincinnati, O. A housing with pure water storage tank in upper portion, platform above, primary receiving tank thereon, tanks of chemicals in solution, mixing trough and tank, wheel operating moving parts, settling chamber, filter, connecting pipes and valves, outlet for treated water.

731,595. June 23, 1903. Concrete-Steel Sidewalk. William Mueser, New York, N. Y. A concrete-steel sidewalk centrally supported on the spandrel wall of a bridge or viaduct and engaging therewith through offsets in the two and anchored

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IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Sycamore, Ill.—The Federal Asphalt Paving Co., of Chicago, which has the contract for paving in this city, is getting its plant in readiness to begin asphalt paving as soon as the weather will permit, according to press reports of March 2.

Washington, Pa.—A recent issue of bonds, amounting to $82,000, for paving and park improvements, is invalid and the successful bidders, a Philadelphia firm, refuse to accept them. The ballots were prepared according to the act of 1874 and not in accordance with the act of 1903.

CONTEMPLATED WORK.

Barre, Vt.—Some paving is contemplated.

Worcester, Mass.—Salem and Cambridge-sts. will be paved.

Dallas, Tex.—Asphalt paving is contemplated for Worth-st.

Walla-Walla, Wash.—Paving is proposed for Alder and Main-sts.

Kearny, N. J.—The macadamizing of Chestnut-st. is contemplated.

Kenton, O.—An ordinance has been passed for paving E. Franklin-st.

Tuscaloosa, Ala.—Paving is contemplated for the principal streets.

Fremont, Neb.—Brick paving is contemplated for Fifth, Main and F-sts.

Elysian, Minn.—The question of building cement walks is being agitated.

Xenia, O.—The improvement of Detroit-st. is contemplated. City Engineer McKay.

Fort Plain, N. Y.—This town voted March 15 to appropriate $5,000 for paving.

Sayre, Okla.—An ordinance is proposed providing for the building of sidewalks.

Woodbury, Conn.—Bids will be asked for soon for altering the Minortown-road.

Easthampton, Mass.—This town has appropriated $5,000 for macadamizing Main-st.

San Francisco, Cal.—Basalt block paving is contemplated for 1,453 feet of East-st.

Faribault, Minn.—The question of paving the business streets is being agitated.

Pekin, Ill.—The bd. of local impvts. has decided to pave a number of streets and alleys.

Atlanta, Ga.—Council has voted to improve twenty streets with chert, at a cost of $14,000.

Omaha, Neb.—Andrew Rosewater, cy. engr., has submitted the revised paving specifications.

Findlay, O.—Asphalt block paving is proposed for W. Sandusky-st., from Main-st. to Factory-st.

Effingham, Ill.—The question of street paving will be considered by the city council, March 22.

Ironton, O.—Brick or block asphalt paving is contemplated for Vernon and Washington-sts.

Youngstown, O.—A petition has been submitted to the B. P. S. asking that Valley-st. be paved.

Celina, O.—A petition is being circulated for paving Logan-st., from Main to the C., H. & D. railroad.

Malone, N. Y.—This village voted to expend $2,750 on improving the highways this summer. Vil. Clk.

Newcastle, Pa.—Plans have been completed and bids will be asked soon for building 2,700 ft. of road.

Albion, Ill.—The village council has decided to issue $3,000 bonds for building more brick sidewalks.

Kansas City, Mo—The council has authorized the repaving of Walnut-st. from Sixteenth-st. to Nineteenth-st. with asphalt.

Denver, Colo.—Specifications have been adopted for paving Welton-st. from Twenty-second-st. to Thirtieth-st. with asphalt.

Albany, N. Y.—Ordinances have been approved for paving Herkimer, Franklin, Division and Union-sts.

Grand Rapids, Mich.—Block asphalt for N. Union-st. and sheet asphalt for N. Prospect-st. are proposed.

Philadelphia, Pa.—Bids will be asked soon for repaving Delaware-ave., from Vine to South-sts. Dir. Costello.

Oakland, Cal.—Resolutions of intention have been passed for building cement sidewalks on certain streets.

Painesville, O.—The clerk of the B. P. S. has been authorized to advertise for bids for paving E. Main-st.

San Francisco, Cal.—Bituminous rock paving has been petitioned for on Corbett-st., from Seventeenth to Douglass-sts.

Springfield, Ill.—Paving is contemplated for an alley between Sixth and Eighth-sts., from Edwards to Cook-sts.

Anderson, Ind.—Petitions are being submitted to the City Council, asking that the streets be paved with brick.

Marion, Ind.—Asphalt paving has been petitioned for on Gallatin-st., from Third to Thirty-first-sts. Mayor Kiley.

Ft. Smith, Ark.—An ordinance has been adopted providing for the construction of sidewalks on certain streets.

West Palm Beach, Fla.—The question of issuing bonds for street paving and other improvements is being considered.

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Naugatuck, Conn.—Bids for laying cobble gutters in this borough have been authorized. W. J. Neary, borough clerk.

Evanston, Ill.—Ordinances have been passed for paving certain streets and alleys with brick. John N. Moore, city engineer.

Argentine, Kas.—The Commercial Club is advocating the construction of a macadamized road from this city to Turner.

Mt. Holly, N. J.—This town voted, Mar. 22, to issue $15,000 bonds for paving two streets with vitrified brick.

Duluth, Minn.—The bd. of pub. wks. is preparing to let contracts for paving E. Superior, Second and First Ave. East.

Morgantown, N. C.—The town commissioners have decided to build concrete pavements with stone curbing on Union street.

Youngstown, O.—A petition is being circulated for paving Wilson ave. with Bessemer repressed brick with stone curbing.

Manchester, N. H.—Council has appropriated $15,000 for granite block paving on concrete foundation. H. P. Simpson, chm. st. and park comrs.

Washington, D. C.—Favorable reports have been made in the form of amendments to the District appropriation bill for paving 7th st. with asphalt.

Ithaca, N. Y.—Bids will be asked this summer for paving portions of Spencer, N. Aurora, Fall, Lake, Heustis and N. Tioga sts. and Dryden road.

Milwaukee, Wis.—The Milwaukee Monument company has made a proposition to the board of public works proposing to pave certain streets with granite.

Hamilton, O.—Buckeye st. from Front to 4th will be paved with block asphalt, sheet asphalt or vitrified brick. L. A. Dillon, cy. engr.

Painesville, O.—A committee, accompanied by H. P. Cumings, cy. engr., visited Warren, O., Mar. 15, for the purpose of inspecting asphalt block paving.

Ashland, Wis.—About 19,000 sq. yds. of macadam paving, 18,000 sq. yds of asphalt paving, and 15,000 lin. ft. of cement curb and gutter is contemplated this year. M. T. Doane, cy, engr.

Cincinnati, O.—The B. P. S. decided, March 17, to repair, under 1-yr. contracts at a stated price per sq. yd. for work actually done, all asphalt streets not under contract or ordered resurfaced.

Dayton, O.—Ordinances have been passed providing for grading and graveling Edgar ave., from Wyoming to Wayne; grading and paving with boulders. Dutoit-st. and an alley. C. Preston Floyd, clk. coun.

prest., is reported as being in favor of creosoted blocks.

Newport, Ky.—The city council has authorized the improvement of a number of streets by original construction; brick paving with combined curb and gutter on Central-ave.; asphalt paving on Fourth-st. east of Park-ave. Supt. pub. wks. Krebs.

Chillicothe, O.—Ordinances are proposed providing for paving Second-st. from Ohio & Erie canal to N. & W. tracks, with vitrified brick, asphalt or other material; Walnut-st. from Second to Fifth-sts. with vitrified brick, asphalt or other material.

Springfield, O.—An ordinance is pending providing for paving E. High-st. from Greenmount to Belmont-aves. with asphalt, asphalt block and bituminous macadam. The macadamizing of Fremont-ave. from Limestone to Clifton-ave. is also contemplated.

Charleston, S. C.—(Special) J. H. Dingle, cy. engr. says that the bd. of pub. wks. is discussing the matter of constructing 40,000 sq. yds. of brick paving and 5,000 sq. yds. of granite paving, but the time for receiving bids has not yet been determined.

Salt Lake City, Utah—(Special) L. C. Kelsey cy. engr. says bids will be opened about April 20 for 5,000 sq. yds. of asphalt or bituminous macadam paving on First-st. About 40,000 sq. yds. of asphalt paving on S. Temple-st. is also contemplated, but has not yet been ordered.

Little Rock, Ark.—An ordinance has been passed re-enacting the establishment of asphalt improvement district No. 1, which was made necessary reason of error in the ordinance passed Aug. 10, 1903. Ordinances were also passed for building concrete walks and curbing on certain streets. Mayor Lenon.

Brooklyn, N. Y.—The Brunswick board adopted resolutions Mar. 16 for granite paving on Crescent-st., between Liberty and Belmont-aves., and asphalt paving on Pine-st., between Fulton-st. and Ridgewood-ave., and Milford-st. from Atlantic to Pitkin-aves. The Flatbush and Bushwick boards are also considering the paving of Sherlock Place, between Atlantic and Herkimer, with asphalt.

CONTRACTS TO BE LET.

La Crosse, Wis.—Bids are asked until 2 p. m. April 2 for grading Seventeenth-st Board of Public Works.

Muncie, Ind.—Bids are asked until April 4 for improving sidewalks. R. G. Hickok, city clerk.

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til April 2 for 5,850 square yards of paving on Ohio-st. City Engineer.

Washington, Ind.—Bids are asked until April 5 for building twenty-six miles of rock road in Bar Township. County Commissioners.

Pacific Grove, Cal.—Bids are asked until May 9 for 5,269 square yards of paving. E. B. Lewis, City Clerk.

Lima, O.—Bids are asked until April 3 for grading, curbing and paving Pine-st. O. J. Rose, Clerk B. P. S.

Oshkosh, Wis.—Bids are asked until April 15 for grading and granite top macadam on Merritt-st. Board of Public Works.

Cincinnati, O.—Bids are asked until April 5 for repairing asphalt pavements on several streets. B. P. S.

Portland, Ind—Bids are asked until April 4 for building a free gravel road in Noble twp. Jay Griffith, engr.

Chester, Pa.—Bids are asked until April 4 for curbing and paving. S. B. Pennington, chmn, com. on sidewalks.

Bowling Green, O.—Bids are asked until April 12 for grading, draining and macadamizing 3 sections of road. Co. Comrs.

Jacksonville, Fla.—Bids are asked until April 6 for paving about 5 mls. of county roads. P. D. Cassidy, clk. co. comrs.

Georgetown, Del.—Bids are asked until 12 m. April 5 for building macadam road. Chas. G. Fisher, engr.

Woonsocket, R. I.—Sealed bids are asked until 4 p. m. April 7 for paving Main and Cumberland sts. F. H. Mills, cy. engr.

Kansas City, Mo.—Sealed bids are asked until April 4 for paving a large number of streets with asphalt. D. W. Pike, cy. engr.

Maywood, N. J.—Bids are asked until April 4 for macadamizing and guttering Park, Grove, Hunter, Central aves. and Elm st. Coun.

Winfield, Kas.—Bids are asked until 5 p. m. April 4 for curbing both sides of 9th ave. with concrete. Earl M. Hartley, cy. clk.

Paoli, Ind.—Sealed bids are asked until 2 p. m. April 6 for constructing 3 gravel or macadam roads. Geo. W. Tegarden, co. audt.

Norfolk, Va.—Sealed bids are asked until 12 m. April 15 for about 2,600 sq. yds. of asphalt paving. B. G. Tunstall, chmn. st. bd.

Stevens Point, Wis.—Sealed bids are asked until 12 m. April 14 for improving Clark and S 3d sts. Thos. A. Humphrey, chmn. B. P. W.

Bradford, Pa.—Bids are asked until April 11 for paving 5 streets with vitrified brick, concrete foundation, etc. A. F. Bannon, Jr., cy. engr.

Escanaba, Mich.—Council has authorized about $50,000 worth of paving for this summer, but no definite steps have yet been taken toward doing the work.

West Bay City, Mich.—(Special.)—H. C. Thompson, cy. engr., says that 44,000 sq. yds. of asphalt or brick paving on concrete foundation is contemplated.

Fall River, Mass.—An ordinance has been passed providing for 14,000 ft. of granite curbing and 225,000 granite paving blocks. F. A. Thurston, supt. sts.

San Jose, Cal.—Plans and specifications are being prepared for paving Virginia-st., with gravel with artificial stone sidewalks and curbing. Cy. engr. Pipper.

San Francisco, Cal.—The Harbor comn. is considering the improvement of the water front by constructing a basalt block roadway 1,453 feet length.

Minneapolis, Minn.—The paving committee decided March 16, on considerable creosoted wood block, sandstone, vitrified brick, macadam, and cedar block paving.

Milwaukee, Wis.—Asphalt paving has been recommended for Brady-st. from Farwell-ave. to Prospect-ave., and brick paving for portions of Brady, Johnson and Park-sts.

Cincinnati, O.—Resolutions have been passed to improve Lawrence, McAllister, Eighth, Plum and Clark-sts. with asphalt, Smith-st. with granite, and Buchanan-st. with brick.

Baltimore, Md.—Mayor McLane has approved ordinances for paving Grove-st. with vitrified brick, Twenty-first-st. with coblestone and macadamizing Walbrook-ave.

Massillon, O.—(Special.)—Harold Howald, cy. engr., says that bonds will be sold April 15, and bids asked soon thereafter for 44,817 sq. yds. of brick paving on gravel foundation.

Albany, N. Y.—Ordinances have been passed for paving Franklin-st. from Madison-ave. to Gansevoort-st.; Herkimer-st. from S. Pearl to Broadway; Division-st. from S. Pearl to Broadway.

Rosedale, Kas.—The city council passed an ordinance March 15, authorizing the paving of the Southwest boulevard. Paving is also contemplated for all the principal streets this summer.

Elizabeth, N. J.—Bids are asked until April 15 for paving Front and S. Park-sts. with trap rock, with new curbing. W. H. Luster, cy. clk.

Mt. Vernon, N. Y.—Bids are asked until 8 p. m. April 5 for laying flag walks, cross walks and curbing for ensuing year A. W. Reynolds, cy. clk.

Ithaca, N. Y.—Bids are asked until April 6 for macadamizing 5 streets and paving Heustis and N. Tioga-sts. with brick. John Miller, cy. clk.

Elgin, Ill.—Bids are asked until April 5 for 2,600 sq. yds. vitrified brick paving on 5-in. cement base. A. H. Hubbard, prest. bd. local impvts.

Topeka, Kas.—Bids are asked until 5 p. m. April 4 for completion and construction of condemned sidewalks and others ordered. J. H. Squires, cy. clk.

Mobile, Ala.—Sealed bids are asked until April 20 for asphalt, granite block, vitrified brick and wooden block paving. C. L. Lavretta, prest. B. P. W.

Winnipeg, Man.—Sealed bids are asked until April 12 for supplying 500 to 1,000

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tons of asphalt and 15,000 to 25,000-bbls. of cement. C. J. Brown, cy. clk.

Columbus, Grove, O.—(Special) Sealed bids are asked until April 16 for 6,393 sq. yds. of brick street paving on stone foundation. O. C. Talbot, engr., Ottawa, O.

Opelousas, La.—Bids are asked until April 15 for 3,700 ft. cement walk, with brick curbing, and 9,000 ft. brick walk with brick curbing. B. A. Littell, mayor.

Columbus, Ind.—Sealed bids are asked until 1 p. m. April 4 for building 1-mi. and 3,744 ft. of gravel road between Jackson and Wayne twps. Wm. A. Morris, co. audt.

Oshkosh, Wis.—(Special)—Bids will be received until April 4 for 8,000 sq. yds. of macadam paving and gutter and curbing on Evans-st. Geo. H. Randall, cy. engr.

Hasbrouck Heights, N. J.—Sealed bids are asked until 8 p. m. April 4 for furnishing and laying flag, curb, gutter and macadam on certain sts. G. H. Ramsden, boro clk

Salem, N, J.—Sealed bids are asked until April 13 for grading and placing oyster shell surface on Salem and Pennville road, about 6 mis. Wm. J. Freas, dir. freeholders.

South Bend, Ind.—Bids are asked until 6 p. m. April 4 for grading, curbing and cement walks in town of River Park. J. B. Walker, chmn. bd. town trustees, River Park.

West Bay City, Mich.—Bids are asked until 7:30 p. m. April 11 for brick or asphalt paving on Washington-st., from C., S. & M. Railroad crossing to Patterson-ave. Cy. clk.

St. Louis, Mo.—Sealed bids are asked until 12 m. April 5 for completing the government road between Springfield, Mo., and the National Cemetery. Major Thomas Cruse, Depot Q. M.

Chicago, Ill.—Sealed bids are asked until 2:30 p. m. April 20 for furnishing and delivering filling required for Grant Park, 3,000,000 cu. yds. E. G. Shumway, secy. South Park Comrs.

Augusta, Ga.—Sealed bids are asked until April 12 for resurfacing Broad-st., from Fifth to Twelfth, with asphalt, brick, small Belgian block or macadam. Nisbet Wingfield, cy. engr.

Davenport, Ia.—Sealed bids are asked until 2 p. m. April 5 for vitrified brick paving on concrete base on Rock Island, Perry and Main-sts., Tremont-ave. and an alley. Thomas Murray, cy. engr.

Washington, D. C.—Sealed bids are asked until 12 m. April 5 for furnishing, at navy yards, League Island, Pa., vitrified paving blocks, c. i. pipe, fittings, gate valves, etc. H. T. B. Harris, paymaster-general U. S. N.

Muskegon, Mich.—Sealed bids are asked twp. John Bultman, chmn. co. comrs.; Nicholas Volz, co. audt.

Sullivan, Ind.—Sealed bids are asked until 11 a. m. April 5 for building 3 mis. and 3,886 ft. of gravel or macadam road in Fairbanks twp.; 3 mis. and 1,460 ft. in Jefferson twp.; 6 mis. and 1,076 ft. in Gill twp. J. M. Lang, co. audt.

Cortland, N. Y.—Sealed bids are asked until 8 p. m., April 4, for 7,350 sq. yds. of macadam and 4,050 sq. yds. of brick paving, 7,000 lineal ft. stone curb and header, 50 cu. yds. concrete, and 1,000 lbs. cast iron. S. S. Knox, president board public works.

Meadville, Pa.—Sealed bids are asked until April 6 for 360 sq. yds. brick paving, 390 lin. ft. curbing, and 16 lin. ft. edge stones, on Mulberry-alley, also for 258 sq. yds. of brick paving on Cherry-alley. A. C. Pardee, city clerk.

Ridgefield Park, N. J.—Sealed bids are asked until 8 p. m., April 11, for 12,600 sq. yds. of Telford macadam and 20,000 sq. yds. of macadam paving, 18,000 sq. yds. excavation, 48 manholes brought to grade, and 1,600 sq. ft. cross bridge relaid. John DeGroat, village president.

Woodruff Place, Indianapolis, Ind.—Sealed bids are asked until 8 p. m., April 8, for paving the north side of Michigan-st., from the west to the east line of Woodruff Place. Marion County, with creosoted wooden blocks on 6-in. concrete base, with curbing. George Brown, president board of trustees. A. C. Thomas, town clerk.

Indianapolis, Ind.—Sealed bids are asked until April 6 for paving Pennsylvania-st. from South to Merrill, with brick on 6-in. gravel concrete foundation. Until April 4 for paving Michigan-st. from Pogue's Run to Tacoma-ave. with creosoted wooden blocks. Until April 8 for cement sidewalks on portions of New York-st. and Woodlawn and Warman-aves., and grading and rolling Drexel-ave. M. A. Downing chairman board public works.

CONTRACTS AWARDED.

Little Rock, Ark.—The contract for paving Shell-alley with macadam was awarded March 18 to Charles Torbert.

Ithaca, N. Y.—Contracts for paving Stewart-ave. and W. Buffalo,st. have been awarded to Eugene McGreevy.

Washington, Ind.—The contract for building the Elnora gravel road was awarded to Hart & Anderson for $19,000.

Riverside, Cal.—The contract for paving Main-st., from First to Fifth, was awarded to McIntyre & DeGyrse for $7,678.47.

Meriden, Conn.—The contract for constructing a roadway in this city was awarded to Thomas Kearney, city, for

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Beacon Falls, Conn.—The contract for grading and graveling a section of road was awarded to Frank Brazos of New Haven for $7,200.

Princeton, Ind.—The contract for constructing the Patoka rock road was awarded to Charles White & Co. of Booneville for $63,000.

Geneva, N. Y.—The contract for paving a number of streets with brick was awarded to Thomas Fitzgerald of Fredonia for about $30,000.

Cadillac, Mich.—The Central Bitulithic Company of Detroit was awarded the contract, March 21, for paving six blocks of Mitchell-st.

Utica, N. Y.—The contract for constructing bitulithic paving in certain streets was awarded, March 12, to Warren Bros. Company of Boston.

Hartford, City, Ind.—The contract for paving Jefferson, Main and High-sts. with brick was awarded, March 3, to Nolan & Slattery, at $1.72 a sq. yd.

Spokane, Wash.—The contract for paving First-ave., from Madison to Walnut, with asphalt, was awarded, March 13, to the Barber Asphalt Paving Company, at $3.41 a sq. yd.

Kansas City, Mo.—The Barber Asphalt Paving Company was awarded the contract, March 15, for paving Eighteenth-st. from Indiana to Jackson with asphalt, for $11,932.50.

Los Angeles, Cal.—The Fairchild-Gilmore-Wilton Company was awarded the contract for paving Fourth-st. from Main to San Pedro, with asphalt, according to local press reports.

McKeesport, Pa.—Bowman Bros. secured the contracts for paving Evans-ave. for $6,900, and Federal-st. for $7,500 and W. W. Kelly the contract for Stewart-st. for $8,150.

Natchitoches, La.—The contract for 4,400 sq. yds. of vitrified brick paving was awarded to the Miller Paving Company of Memphis, Tenn., at $2.33 a sq. yd.

Bay City, Mich.—The contract for paving Washington-st. with brick was awarded to W. J. Meagher, March 15, for $32,638, and for paving the crossings to R. Donohue, for $7,600.

Tacoma, Wash.—The contract for paving Pacific-ave. from 7th to 17th-sts. was awarded, Feb. 27, to F. A. Keasal, who will pave the street with vitrified brick for $48,967.

Muscatine, Ia.—(Special)—Brick paving contracts were awarded, March 3, as follows: Dist. No. 21, Davenport Const. Co., $63.375.05; Dist. No. 22, McCarthy Impvt. Co., $62,531.40.

Brooklyn, N. Y.—The Uvalde Asphalt Co. secured the contract, March 11, for 61,000 ft. of asphalt and surface repair work at $5 a cu. yd. for concrete work and 85c a sq. ft. for surfacing.

Grand Rapids, Mich.—Paving contracts have been awarded as follows: Ellsworth-ave., from Fulton-st. to Wealthy-ave., Albert Prange, $35,286.74; Grandville-ave., Wm. McDermott. $62,500. The streets will be paved with brick.

Chattanooga, Tenn.—Contracts for improvements at the new army post have been awarded as follows: Building chert roads and gutters, Wright, Wilburn & Wadley of Macon, Ga.; building Telford roads, Hall & Thompson, Hill City; building cement walks, Byron Souders.

Detroit, Mich.—The contract for supplying this city with asphalt was awarded, March 14, to the Warner-Quinlan Asphalt Co. of Syracuse, N. Y., at $25.50 per ton. The contract for furnishing cedar was awarded to Currie & Conn, at $9.42 for No. 1 and $6.75 for No. 2.

St. Louis, Mo.—Paving contracts were awarded, March 9, as follows: Fruin-Bambrick Const. Co., Page-boul., Park-ave., 13th and 18th-sts.; Gottlieb Eyermann, Maffitt-ave.; Granite Bituminous Paving Co., Boyle-ave. and three sections of Hickory-st.; Gilsonite Const. Co., Broadway-st.

Davenport, Ia.—The contracts for brick paving were awarded, March 15, as follows: Leonard, Washington and Locust sts., Davenport Construction Co., exca., 32 cts; paving, $1.65; curb, 52 cts; People's Construction Co., Fulton-ave., exca., 36½ cts; paving, $1.61; curb, 54 cts; 12th-st., exca., 40 cts; paving, 60 cts; curbing, 34 cts; 13th-st., exca., 38 cts; paving $1.60; curbing, 34 cts; 10th-st., exca., 35 cts; paving, $1.59; 16th-st., exca., 39 cts; paving, $1.62; curbing, 34 cts; Cedar Rapids Asphalt Co., Tremont-st., exca., 30 cts; paving, $1.93; curbing, 65 cts.

SEWERS.

Trenton, N. J.—Vice-Chancellor Grey decided March 15 to allow an order directing the city of Bordentown to abate a nuisance arising from the pollution by sewage of Thorntown Creek within one year. This case has been in the courts three years and was instituted by the congregation of the Mission of St. Vincent de Paul, of Bordentown, through the property of which the creek runs. The city will be compelled to build a new sewer.

CONTEMPLATED WORK.

Minonk, Ill.—A sewerage system is proposed.

Sheldon, Ia.—A sewerage system is advocated.

Newton, Ill.—A new sewerage system is urged.

Binghamton, N. Y.—A sewer in Pearl-ave. is proposed.

Madison, Me.—The construction of sewers is contemplated.

Parkville, Mo.—A sewerage system in sewer dist. No. 1 is proposed.

Shelbyville, Ind.—The construction of a large sewer is contemplated.

Eugene, Ore.—The extension of the Jefferson-st. sewer is contemplated.

Gardner, Mass.—This town has appropriated $4,500 for building sewers.

Cape Girardeau, Mo.—Surveys and estimates are being made for sewers.

South Bend, Ind.—Plans are being made for a larger sewer in South Bend-ave.

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South Whitley, Ind.—The construction of a sewerage system is contemplated.

Marshfield, Ore.—A survey is being made for building a sewerage system.

Havre de Grace, Md.—Surveys for a sewerage system will be made. C. C. Pusey, mayor.

Marshfield, Wis.—Council will take action April 5 on the proposed North Side sewer.

Wilton, N. H.—A committee is considering the question of building a sewerage system.
storm sewers has been recommended by C. L. Huggins, cy. engr.

Batavia, N. Y.—This village voted to build a sewerage system at a cost of $300,000 to $375,000.

Zanesville, O.—A resolution has been adopted to build a storm sewer in Market-st., from Underwood to McOwen.

Lansing, Mich.—The construction of sewers in Isaac and Cedar-sts. and Capitol-ave. is contemplated.

Charleston, S. C.—The question of improving the sewers or constructing a modern system is being urged.

Belleville, Ill.—The estimated cost of the proposed intercepting sewer and septic tank system is $76,000.

Fresno, Cal.—The extension of the outfall sewer and erection of a septic tank is contemplated. Mayor Stephens.

Kenton, O.—The city engineer has been directed to prepare plans and specifications for a sewer in Waldeck-st.

Covington, Ind.—Bids will probably be asked in May for building sewers and pavements. W. H. Miles, city engineer.

San Francisco, Cal.—City Engineer Grunsky has recommended that this city expend $67,750 for new sewers this year.

Long Branch, N. J.—The Long Branch Sewer Co. contemplates the construction of a new outlet pipe about 1,000 ft. long.

Louisville, Ky.—Surveys for sewers in the southwestern part of the city have been made by J. B. F. Breed, city engineer.

Sterling, Ill.—The question of building a modern sewerage system is still being agitated, at a cost of about $500,000.

Lansing, Mich.—The city engineer has been directed to prepare plans for a sewer in Isaac-st., from Walnut-st. to the river.

Platteville, Wis.—(Special)—Phil. D. Hendershot, city clerk, says a plat is being made and a sewerage system is contemplated.

Buffalo, N. Y.—(Special)—A resolution has been adopted to build a 12 and 10 in.

Fitchburg, Mass.—A special committee has been appointed to consider plans for completing the sewage disposal works. J. W. Merrian, chmn.

Houston, Tex.—The question of issuing $650,000 bonds for constructing a complete sanitary and storm sewerage system will be voted on June 27.

Chattanooga, Tenn.—The question of building a sewerage system to relieve that part of the city lying in the manufacturing district is being considered.

Columbus, O.—An ordinance has been passed providing for erecting, equipping and operating a sewage disposal testing station. Geo. D. Jones, prest. coun.

Portland, Ore.—Bids will be asked at once for constructing the proposed new Brooklyn main sewer, which will drain a region of about 3 sq. mis. in extent.

Rochester, N. Y.—The ordinance providing for a 70-ft. tunnel to carry the overflow in times of flood was favorably reported on Mar. 15. E. A. Fisher, cy. engr.

Alma, Mich.—(Special) G. S. Young, vil. prest., says that this village will construct 1½ mi. of sewers. Plans for the same are being made by J. G. Chase, cy. engr.

Minneapolis, Minn.—The cost of constructing concrete steel sewers, in comparison with the present brick construction, is being considered by Carl Ilstrup, city sewer engr.

Mansfield, O.—(Special) Bids will probably be received some time in June for constructing 6,000 lin. ft. of trunk and main sewers, and about 3,000 ft. of laterals. Cy. engr. Keith.

Aberdeen, S. D.—The question of issuing $150,000 sewer and water bonds will be voted on April 19. The sewer plans involve the construction of a septic disposal tank system and beds.

St. Louis, Mo.—Sewer comr. Valliant has decided to try septic tanks in the disposal of sewage from a district bounded by Loughborough ave., Iron st., Michigan ave. and Carondelet Park.

Brooklyn, N. Y.—The Bushwick board has adopted resolutions to construct sewers in Stanhope and Crescent sts. The Flatbush board has adopted resolutions to build sewers in E. 31st st., Greenwood ave., Canarsie ave., E. 29th and E. 28th sts.

Philadelphia, Pa.—Plans are being considered which provide for the construction of large intercepting sewers along the line of the Schuylkill and Delaware

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West Side trunk sewer. L. W. Anderson, cy. engr.

West Carrollton, O.—Bids are asked until 12 m. April 4 for building a village sewer. Vil. clk.

Mansfield, O.—Bids are asked until April 16 for building 6,000 ft. of lateral sewers. Cy. Engr. Keith.

Perth Amboy, N. J.—Bids are asked until April 4 for reconstructing Washington st. sewer. Matt Weirup, st. comr.

Kinston, N. C.—Bids are asked until April 18 for building about 5 mls. of 8 to 22-in. sewers. N. J. Rouse, mayor.

Columbus, Ind.—Bids are asked until April 12 for constructing 2,195 ft. of brick and 6,874 ft. of pipe sewers. W. H. Rights, cy. engr.

Trenton, N. J.—Sealed bids are asked until April 5 for building sewers in Monmouth, 2nd and Clark sts. H. B. Salter, cy. clk.

Des Moines, Ia.—Bids are asked until April 12 for building 4,660 ft. of sewers in 7th, Parnell and Bowman ave. B. O. Hanger, chmn. B. P. W.

Salt Lake City, Utah—Bids are asked until April 6 for constructing 16,600 lineal feet of eight, ten and twelve-inch pipe sewer. L. C. Kelsey, City Engineer.

Elizabeth, N. J.—Bids are asked until April 15 for building a sewer, with manholes, in Amity-st. W. H. Luster, City Clerk.

Cincinnati, O.—Sealed bids are asked until April 9 for constructing a masonry drain on Red Bank road, Columbia Township. E. L. Lewis, County Auditor.

Laporte, Ind.—Bids are asked until April 11 for building 2,300 feet of sewers in Niles, Woodward and Ridge-sts. C. E. Wolfe, City Clerk.

Glassport, Pa.—Bids are asked until April 11 for building a brick sewer in Ninth-st. and a terra cotta sewer in Cherry-alley. P. S. McMullen, Borough Engineer.

Chicago, Ill.—Sealed bids are asked until April 6 for constructing house drains in eighteen streets and systems of streets. A. M. Lynch, President Board of Local Improvements.

Washington, D. C.—Sealed bids are asked until April 23 for furnishing gate valves for the sewerage pumping station. H. B. F. McFarland, Chairman District Commissioners.

Edwardsville, Ill.—Sealed bids are asked until April 4 for building a sewerage system, with manholes, catch-basins, etc. H. P. Hotz, President Board of Local Improvements.

Chicago, Ill.—Sealed bids are asked until April 7 for a sewer and septic tank at the St. Charles Home for Boys. R. S. Tuthill, President Board of Trustees. 602 LaSalle-st.

Menominee, Mich.—Sealed bids are asked until April 7 for constructing sewers in Williams, Marinette and Baker-aves., and Maud and Parmenter-sts. F. S. Norcross, City Clerk.

Hackensack, N. J.—Sealed bids are asked until April 4 for constructing about 1,572 feet of two-foot brick sewer, sixteen manholes and nine catch-basins. Jacob Bauer, President Improvement Committee.

Oshkosh, Wis. (special)—Bids are asked until April 4 for constructing 3,700 lineal feet of eighteen, fifteen and fourteen-inch pipe sewers on Fourteenth and Fifteenth-sts. and Prospect-ave. George H. Randall, City Engineer.

Birmingham, Ala.—Sealed bids are asked until April 7 for constructing sections 6, 7, 8, 9 and 10 of the Valley Creek sewer. R. B. Smyer, Linn building, Secretary Jefferson County Sanitary Board; Julian Kendrick, Chief Engineer.

Bay City, Tex.—Bids are asked until April 2 for building 2,971 feet of fifteen and 1.890 feet of twelve-inch storm sewer, with necessary inlets; 6,922 feet of brick gutter; 6,762 feet of cypress curbing. W. M. Holland, Mayor.

Rockford, Ill.—Sealed bids are asked until 11 a. m. April 4 for constructing the Prairie and Eighth-st. sewerage systems and sewers in Eleventh and Fourteenth-aves., and Eleventh, Charles, N. Second, Benton and East-sts. Charles E. Jackson, President Board of Local Improvements.

Butler, Ind. (special)—Bids are asked until May 2 for building a sewerage system, including 41,775 feet of 60, 36, 30, 24, 18, 15, 12, 6 and 4-inch sewers; 60 manholes, 200 pipe catch-basins, 800 lot specials, 35 pipe lampholes, 25 pipe flushing holes. J. H. W. Krontz, City Engineer.

CONTRACTS AWARDED.

Newport, Ky.—The contract for building a sewer in Arnold-alley was awarded to Fred McLane.

Kearny, N. J.—William Green was awarded the contract for building a sewer in Bergen-ave. for $1,060.

Asheville, N. C.—J. R. Rich & Son secured the contract for building a sewer in Catawba-st. for $233.15.

Casper, Wyo.—The contract for constructing a sewerage system was awarded to O'Brien & Rhoades of Denver for $11,-137.

Terre Haute, Ind.—The contract for constructing a 12-in. sewer on Eighth and Spruce-sts. was awarded to Donn Roberts for $1,894.35.

St. Paul, Minn.—Christ Johnson was awarded the contract for building a sewer in S. Robert-st. from Morton to Dearborn for $3,266.

Atlantic, Ia.—The contract for constructing a sewerage system has been awarded to W. A. Edgar of Cedar Rapids, Ia., for $11,950.

Buffalo, N. Y.—(Special)—The contract for a 20, 18, 15 and 12-in. sewer in Humason-st. was awarded to Frederick J. Mumm for $2,349.

Scranton, Pa.—The contract for constructing sec. G of the 17th sewer district was awarded to Egli & Co. of South Scranton for $53.000.

Kansas City, Mo.—Kinlan & McCarthy secured the contract for building an ex-

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tension to the sewer in district No. 249 in Westport for $18,430.

Muscatine, Ia.—Contracts for constructing sewers in Dists. Nos. 1 and 3 were awarded to Peter Weingerter for $924.85 and $1,044, respectively.

West Hartford, Conn.—The Hartford Paving and Construction Co. of Hartford secured the contract for constructing the Charter Oak district sewers for $11,475.35.

Nashville, Tenn.—The contract for extending the sewer from the cotton factory to the Cumberland River has been awarded to the Nashville Plumbing Co. for $8,233.75.

Milwaukee, Wis.—Sewer contracts have been awarded as follows: 1,009 ft. brick sewer in 31st-ave., Herman Hohensee, $7.47 a ft.; 333 ft. sewers in Muskego-ave., C. J. Crilley, $1.77 a ft.

Economy, Pa.—The contract for building a sewerage system has been awarded to Thos. Sweeney & Son, for $30,000. Press reports state that the contract for manholes and drops will increase the contract price to $45,000 or $50,000.

Atlanta, Ga.—Contracts for sewer work during the year have been awarded as follows: Building sewers, A. J. Dunn; furnishing sewer pipe, Sciple & Sons; furnishing cement, Victor H. Kreigshaber; furnishing castings, Withers Foundry Co.

Taylorville, Ill.—(Special) A. B. Alexander, sec'y bd. local impvts., says contracts for a system of surface drainage in this city were awarded, Feb. 1, as follows: Two districts, M. Powell & Son, $8,088; one district, W. H. Bourne, $1,343; Northwestern sewer, Prendergast Construction Co., $11,352.15; enlargement of N. Market-st. sewer, M. A. Hogan, $2,069.30; Gustine-ave. sewer, McIntyre & Teese, $717.25; Delmar-boul., storm sewer, Prendergast Construction Co., $744; sewer inlets and connections, William F. Riley, $2,336.90; sewer in Rock Spring District No. 14, McIntyre & Teese, $31,162.45; sewer in Rock Spring District No. 15, McIntyre & Teese, $5,663.70.

WATER-WORKS.

Depew, N. Y.—Application has been made in the Supreme Court for a writ of peremptory mandamus to compel the Depew & Lake Erie Water Company to furnish this village with a supply of pure, fresh water in such quantities that it can be in condition to protect the lives and the property of the citizens of the village from conflagration.

CONTEMPLATED WORK.

St. Paul, Minn.—Water mains will be laid in a number of streets this year.

Mansfield, O.—(Special)—The installation of meters is contemplated. Cy. engr.

Bishop, Cal.—Plans for a municipal water works system have been submitted, according to press reports.

Petoskey, Mich.—This city will vote on a proposition to issue $22,000 bonds to extend the city water pipes.

Moline, Ill.—D. W. Mead, cons. engr., urges this city to put in a fifth filter bed at a cost of about $2,500.

Scottville, Mich.—This town voted to improve the waterworks system by adding a new pump, well and engine.

Lawrence, Mass.—Plans for additional filters for the water supply have been prepared. C. F. Lynch, mayor.

Menasha, Wis.—The question of acquiring municipal waterworks will be voted on April 5. S. S. Little, cy. clk.

Greenfield, Mass.—The water commissioners contemplate increasing the water supply by the addition of a new reservoir.

Madison, Wis.—John B. Heim, supt. of w w., recommends the construction of a storage basin in his annual report.

Kansas City, Mo.—Ordinances have been passed appropriating several thousand dollars for laying more water mains.

Wheeling, W. Va.—The expenditure of about $800,000 on water works improvements, gas and street work is contemplated.

Youngstown, O.—The B. P. S. has decided to ask for bids at once for the proposed filtration plant. F. M. Lillie, cy. engr.

Cleveland, O.—The question of voting on an issue of $2,000,000 bonds for erecting a filtration plant is being considered.

West Orange, N. J.—A resolution was passed March 22 recommending for consideration the acquiring of a municipal water plant.

Iowa Falls, Ia.—The water works system will be improved this year by new and better equipment and enlarging the works for general use.

The question of issuing bonds for building water works systems will be voted on at the following places: Klemme, Ia.; Waxahachie, Tex.; Atwater, Minn.

New York City—Commissioner Oakley of the department of water supply, gas and electricity has recommended 6 freshwater pumping stations for fire protection.

Madisonville, Ky.—A map is being made of this city by J. E. Morgan of Chicago preliminary to preparing plans and specifications for a system of water works.

Milwaukee, Wis.—The extension of the water system of this city to Wauwatosa for the protection of the county institutions from fire has been recommended by Chief Meminger.

Emporia, Kas.—The city council is negotiating for the purchase of milldam and grove near here, preliminary to building a municipal water-works pumping station

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Mar. 3 directing the board of village trustees to appoint a committee to confer with a committee from the Newark Board of Trade to investigate the cost of constructing a water-works system, prior to making a new contract with the present company.

Wilmington, Del.—The water commission will secure data for furnishing this city with a good water supply, which will then be submitted to an engineer for his opinion before having plans made.

Massillon, O.—(Special)—Harold Howald, cy. engr., says preliminary legislation has been passed for constructing a new water plant, to cost about $200,000. The present plant is owned by a private company.

Charleston, S. C.—Plans and specifications have been approved for constructing the proposed dam at Goose Creek for the purpose of impounding the water and at the same time not closing the creek to navigation.

Buffalo, N. Y.—(Special)—The com'r. of pub. works has been directed to prepare plans and ask for bids for installing a 30,000,000-gal. electric turbine pump and the motor to drive it, at the water-works station.

Crawfordsville, Ind.—A resolution has been passed providing that great care be taken in the matter of making a new contract with the Crawfordsville Water-works Co., and that the matter be carefully investigated.

The question of issuing water-works bonds for building water-works systems has been favorably voted on at the following places: Poland, N. Y.; Alpena, Mich.; Hays City, Kas.; Wiscasset, Me.; Brewster, Minn.; Fountain, Minn.

Columbus, O.—At a meeting of the B. P. S., March 21, Directors Bohl and Pond voted to restrict competition in bidding on the cement work for the new Scioto dam to cement manufacturers that have been in business at least five years.

Walla Walla, Wash.—The special water committee has recommended two plans for the proposed water-works system. One provides for installing a pumping plant at the Thomas ranch, four miles east of this city, at an estimated cost of $64,000, and the other is for a complete gravity system developed by tunneling at a cost of $90,000.

Columbia, S. C.—The water-works commission has submitted its report on the different available sources investigated for supplying this city with water and a new water-works plant. They report that a water supply can be secured from three sources, as follows: Congaree Creek, $647,210; Dent's Pond, $473,700; River, $399,890. The commission recommends the Congaree project.

The question of constructing water-works systems is contemplated at the following places: Frederic, Wis.; Mountain View, Cal.; New Freedom, Pa.; Hebron, Ill.; Anderson, Cal.; Pitkin, Colo.; Lehi, Utah; Bedford, O.; Hinckley, Ill.; Corning, Cal.; Tiverton, R. I.; Lee, Ill.; Hubbell, Mich.; Post Falls, Idaho; Owensboro, Ky.; Dixfield, Me.; Ormstown, Quebec; Janesville, Mich.; Kulm, N. D.; Gleason, Tenn.

CONTRACTS TO BE LET.

Fargo, N. D.—Bids are asked until 5 p. m. April 4, for water main extensions. H. J. Gibson, cy. audt.

Kinston, N. C.—Sealed bids are asked until April 18 for constructing a water-works system. L. J. Mewborne, clk.

Statesboro, Ga.—Sealed bids are asked until April 12 for constructing a water-works system. G. S. Johnson, mayor.

Glenellyn, Ill.—Sealed bids are asked until April 22 for installing a water-works system. A. M. Kelley, vil. clk.

Ligonier, Ind.—Bids are asked until April 14 for erecting a power station at the water-works. H. Jeanneret, cy. clk.

Alexander City, Ala.—Sealed bids are asked until April 6 for constructing a waterworks system. A. P. Fuquay, mayor.

Salt Lake City, Utah.—Sealed bids are asked until April 6 for constructing 15,800 lin ft. 6, 8 and 10-in. water mains. L. C. Kelsey, cy. engr.

Springfield, O.—Sealed bids are asked until April 9 for furnishing and erecting at the pumping station a pumping engine. B. P. S.

Mayfield, Cal.—Bids are asked until April 4 for furnishing casing and boring and completing one or more 10-in. wells. Bd. trustees.

Kennedy Heights, O.—Sealed bids are asked until April 9 for constructing a water-works system. J. M. Baker, clk bd. trustees pub. affairs.

Binghamton, N. Y.—Sealed bids are asked until April 4 for furnishing and installing a pumping engine. John Anderson, supt. water comrs.

Lethbridge, Alberta, Canada.—Sealed bids are asked until April 14 for pumping machinery and boilers for the water-works. C. W. Bowman, secretary-treasurer.

Easton, Pa.—Bids are asked until April 5 for laying about 20,000-ft. of 2 to 4-in. c. i. pipe in the streets. Jos. S. Rodenbough, president Lehigh Water Co.

Stowe, Vt.—Sealed bids are asked until April 4 for laying 2 1-3-mis. c. i. water pipe and necessary gates, hydrants and specials. J. J. Vearen, chairman village trustees.

Dayton, O.—Sealed bids are asked until April 15 for furnishing and delivering 550 tons 6, 8, 10 and 12-in. water pipe with special castings. Louis Hass, president board public works.

Chicago, Ill.—Sealed bids are asked until April 7 for water service, deep well, boilers, engine, etc., for St. Charles Home for Boys. R. S. Tuthill, president, 602 La Salle-st.

Galveston, Tex.—Sealed bids are asked until April 10 for scouring out the 30 artesian wells of the Galveston city water works, located at Alta Loma, Tex. John D. Kelley, city secretary.

New Orleans, La.—Sealed bids are

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asked until May 10 for furnishing 2 gasoline engines, 2 centrifugal pumps and 2 centrifugal pumps with motors. F. S. Shields, secretary sewerage and water board.

Toledo, O.—Bids are asked until April 4 for laying the proposed submerged 20-in. water main across the river from Walnut-st. to Main-st. to connect with a 20-in. main at that point. Board public works.

Harrisburg, Pa.—Bids are asked until April 13 for constructing the municipal filter plant, low-lift pumping station and conduit from island to city. M. B. Cowden, city engineer; A. C. Staun, secretary board public works.

CONTRACTS AWARDED.

Genesee, Idaho—Naylor & Norlin, of Lewiston, have been awarded the contract for installing a waterworks system in this city, for $14,000.

Bardstown, Ky.—The contract for building a water works system has been awarded to J. W. Doolittle & Son, of Corydon, Ind., for about $10,000.

Durant, I. T.—The contract for constructing a water works system was awarded Mar. 3 to H. C. Ullen, jr., of Oklahoma City, for $77,777.72.

East Orange, N. J.—The contract for building a 5,000,000-gal. emergency reservoir has been awarded to the Commonwealth Roofing Co., for $49,525.

Manila, P. I.—The contract for pumping equipment to be installed in the new water works has been awarded to the Gould Mfg. Co., of Seneca Falls, N. Y.

Cambride, O.—The contract for the proposed extension of the water works system has been awarded to W. C. Corcoran & Co., of Pittsburg, Pa., for $13,046.53.

Nashville, Tenn.—The contract for furnishing water pipe to this city has been awarded to the U. S. Cast Iron Pipe Co., of Chattanooga, Tenn., at $21.50 per ton.

Atlantic City, N. J.—The contract for increasing the capacity of the artesian well pumping plant at the Absecon station has been awarded to the Pneumatic Engine Co., of New York City, for $2,645.

Detroit, Mich.—The contracts for building the river tunnel shaft, and crib house has been awarded as follows: crib house W. J. Gawne Co., of Cleveland. $74,750; shaft and river tunnel, C. H. Fathe & Son, $112,194.

Buffalo, N. Y.—(Special) The Snow Steam Pump Co. has been awarded the

BRIDGES.

Ackley, Ia.—A petition is being circulated for a bridge on S. Cerro Gordo-st.

Ontonagon, Mich.—A steel and stone bridge over Ontonagon River is contemplated.

Redding, Cal.—The Merchants' Club is urging the building of a new steel bridge across the river.

Wichita, Kas.—Bids are asked until April 18 for building 3 steel bridges. Hudson Bateman, clk.

Ogden, Utah.—City Council has voted to construct a viaduct across the railroad tracks on Twenty-fourth-st.

Liberty, Mo.—Bids are asked until May 3 for an iron and steel bridge over Coon creek. Bridge comr.

Green Bay, Wis.—City Council has ordered plans prepared for a bridge across East River at Webster-ave.

Rathdrum, Idaho.—Bids are asked until April 11 for building a Hoodoo Meadow bridge. T. L. Quales, co. clk.

Long Island City, L. I.—Bids are asked until Apr. 7 for a new bridge over Flushing creek. Comr. of bridges.

Steamboat Springs, Colo.—Bids are asked until Apr. 18 (extended from Apr. 8) for a bridge across Yampa river.

Bluffton, Ind.—Bids are asked until Apr. 6 for building several small county bridges. C. S. Brennemen, co. audt.

Howard, S. D.—Bids are asked until Apr. 5 for all steel bridges to be built during year. Frank Smith, co. audt.

Milwaukee, Wis.—Plans for the proposed new 5th-st. viaduct are being considered by the viaduct committee.

Richmond, Ind.—Cy. Engr. Weber has prepared 4 plans for the proposed bridge over the White Water river at S. H.-st.

New Richmond, O.—Bids are asked until April 11 for the superstructure of a bridge over Twelve-Mile Creek. H. P. Williams, County Auditor.

Chicago, Ill.—Bids for a new bascule bridge over the Chicago River at Harrison-st. will be received April 13. Drainage Board.

Primeville, Ore.—Bids are asked until May 9 for building a combination Howe truss bridge over Crooked Creek. A. J. Smith, County Clerk.

Ft. Smith, Ark.—Bids are asked until April 14 for building a steel bridge over Mill Creek on Wheeler-ave. road. W. A. Falconer, County Judge.

Delphi, Ind.—Bids are asked until April 4 for building three bridges with stone abutments and one arch culvert. Fred H. Engle, county auditor.

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Spring Branch and one over Little Sugar Creek. J. A. Cady, county clerk.

Topeka, Kas.—Sealed bids are asked until April 4 for building a steel truss bridge on E. Eighth-ave. across the Shunganunga River. J. H. Squires, city clerk.

Versailles, Ind.—Sealed bids are asked until April 5 for the construction of a wagon bridge and abutments across Laghery and Plum creeks. Nicholas Volz

Hackensack, N. J.—Bids are asked until April 5 for stone abutments and a steel beam and brick arch on Grove-st. Walter Christie, chm. co. freeholders.

Lafayette, Ind.—Separate bids will be received April 7 for constructing an iron bridge and substructure over a creek near Hegman's farm. H. H. Cheny, co. audt

Elkhart, Ind.—Sealed bids are asked until April 12 for building stone abutments and an iron bridge over the Elk river in Concorn twp.; also five stone arches. O. H. Sweitzer, co. audt.

Saginaw, Mich.—Sealed bids are asked until April 7 for building a bridge across Saginaw river at Center-st. Also a bridge across Saginaw river at Maple-st., in the village of Carrollton. W. H. Barton, clk. B. P. W.

Hillsboro, Ill.—Sealed bids are asked until 8 p. m., April 19, for constructing a concrete spillway and bridge abutments approximately 310 cu. yds., of concrete, in this city. Geo. A. Clotfelter; Frank P. Winchester, cy. clk.

Cincinnati, O.—Bids are asked until April 16 for improving east approach of suspension bridge over White Water river in White Water twp. E. L. Lewis, co. audt.

Buffalo, N. Y.—(Special)—The common council will ask the Legislature to pass a bill giving this city permission to compel the railroad companies to substitute swing or draw bridges over the Buffalo river. The common council has also directed the commissioner of pub. works to award the contract for the substructure of the Evans-st. bridge to B. I. Crocker. 4 Bidrs. Exchange, and for the superstructure to McClintic-Marshall Const. Co., of Pittsburg.

STREET LIGHTING.

Cumberland, R. I.—A municipal lighting plant is proposed.

Ossian, Ia.—The question of building a gas plant will be voted on.

Livingston, Mont.—The question of an electric light plant is being considered.

Wilson, N. Y.—A company has been organized to light this city by electricity.

Kinston, N. C.—Bids are asked until April 18 for an electric light plant. N. J Rouse, mayor.

New Haven, Ind.—Bids will be received until April 5 for an electric light plant Town bd.

Clarion, Ia.—City council contemplates expending $6,000 in improving the electric light plant.

Burlington, N. J.—A special committee is ascertaining the cost of municipal electric light plant.

Lewiston, Pa.—Bids are asked until April 4 for thirty-five or more enclosed arc lights and 150 incandescent lights.

Cheyenne, Wyo.—Bids are asked until April 9 for electrical work at Ft. D. A. Russell. Capt. W. S. Scott, quartermaster.

Cheboygan, Mich.—Bids are asked until April 5 for wiring the city hall for electric lights. George M. Case, city clerk.

Statesboro, Ga.—Bids are asked until April 12 for constructing an electric light system. C. S. Johnston, mayor.

Waveland, Ind.—A 25 yr. franchise for a commercial lighting system has been granted the Johnson Acetylene Gas Co.

Bay City, Mich.—Question of issuing $50,000 bonds for additions to the electric plant will be voted on April 4.

Wheeling, W. Va.—The estimated cost of a gas plant is $40,000. City Engineer Cook has been directed to prepare plans.

Chicopee, Mass.—The citizens of Ward 7 have appointed a committee to consider the erection of a gas or electric light plant.

East Lake, Ala.—The question of issuing $13,500 bonds for an electric light plant will be voted on April 20. Mayor McKinley.

The question of constructing electric light plants has been voted on [illegible] following places: Watkins, N. Y.; Monticello, Wis.; Valatie, N. Y.

Chattanooga, Tenn.—The contract for installing an acetylene gas plant at Chickamauga Park has been awarded to the Acetylene Apparatus Manufacturing Company of Chicago.

Tarentum, Pa.—Citizens are discussing the advisability of expending from $25,000 to $30,000 in repairing the electric light plant and the adoption of a meter system.

Duquoin, Ill.—The city councils of this city and Pinckneyville contemplate erecting an electric light plant midway between the two towns to provide service for both.

San Antonio, Tex.—Bids are asked until April 6 for lighting the streets, plazas and alleys of this city with gas or electric lights for two years. John B. Campbell, Mayor.

The construction of electric light plants is contemplated at the following places: Papillion, Neb.; Litchfield, Utah; San Jose, Ill.; Bellevue, O.; Tallula, Ill.; Harmon, Ill.; Avoca, N. Y.; Escondido, Cal.; Sayre, Okla.

Pittsburg, Pa.—The contract for lighting the streets of this city during the current year has been awarded sa follows: Allegheny County Light Company, arc lights, 2,000 c. p., $96 a light, and 50 c. p., $35 a light; 60 c. p. incandescent lamps, Cleveland Vapor Light Company at $25.9¢ a lamp and supplying incandescent lamps with plate burners at $19.50.

Brooklyn, N. Y.—Bids are asked until April 4 for a lighting plant for the Twenty-third Regiment Armory. George B. McClellan, Mayor. Bids are asked until April 23 for installing a turbo-alternator

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with excitor set, 5 induction motors, 1 motor generator, 2 switchboards and accessories at Navy Yard pier. M. T. Endicott, Chief Bureau Yards and Docks, Navy Dept., Washington, D. C.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Chicopee, Mass.—Bids are asked until April 4 for collecting garbage for one year. R. D. DeWitt, secy. bd. health.

Mankato, Minn.—The board of health has directed the attention of the council to the need of a crematory for this city.

Galesburg, Ill.—Bids are asked until April 15 for hauling ashes and sprinkling streets during fiscal year. F. A. Freer, custodian.

Jackson, Miss.—(Special) The bd of aldermen has instructed Cy. Engr. W. T. Kirkpatrick to prepare plans and estimates for a garbage crematory.

Indianapolis, Ind.—Bids are asked until April 4 for sprinkling unimproved streets, avenues, alleys and public places from May 1 to Oct. 15, bids to be for 10,000 ft. of roadway. M. A. Downing, chmn. B. P. W.

Dunkirk, N. Y.—(Special)—The Dunkirk Sanitary Reduction Company has made a proposition to take care of all garbage and waste matter from houses and stores at rates varrying from 25 cents to $1. The company expects to build a reduction plant on Bennett road. The board of health has decided to advertise for bids and a five-year contract will be awarded L. E. Hubbard, prest. company.

Omaha, Neb.—Only two bids were re-incinerating garbage. One was an unsigned bid from the City Garbage Company. Based on 5, 10 or 15 year contracts, no bid being submitted for the one year contract. The other bid was from the International Fuel Company and proposed that the city shall build an incinerating plant according to the Engle design and pay to Andrew Engle 12 per cent if the plant costs less than $6,000, or 10 per cent if it costs $8,000 or more. Action on the bids was deferred.

PARKS.

Milwaukee, Wis.—A plan is being considered for establishing a park in Bay View.

New London, Conn.—Plans are being prepared for a new park covering an area of 11 acres.

Newport, Ky.—Sealed bids are asked until April 2 for improving McClure's Park. J. B. Morlidge, cy. engr.

TOO LATE FOR CLASSIFICATION

Huntsville, Mo.—This city voted to issue $18,000 for macadamizing the streets.

Marseilles, Ill.—An ordinance has been passed for paving the main street of this town.

Lorain, O.—Bids for asphalt paving on W. Erie-ave. and Dexter-st. will be asked.

Kansas City, Mo.—Sealed bids are asked until April 4 for brick paving in an alley.

Tiffin, O.—An ordinance has been introduced to pave Greenfield-st. from Market to Prospect.

Winamac, Ind.—Sealed bids are asked until April 12 for constructing roads. Ellis S. Rees, co. audt.

Frankfort, Ind.—Bids are asked until May 7 for constructing a gravel road. Geo. W. Alexander, supt. Wood gravel rd.

Moscow, Idaho—The city sewer committee has secured right of way for constructing a septic tank system of sewerage purification.

Cincinnati, O.—Sealed bids are asked until April 5 for repairing a large number of asphalt streets. Geo. F. Holmes, clk. B. P. S.

Kansas City, Mo.—Plans for a septic tank to be located in the southeast part of the city have been prepared by D. W. Pike, cy. engr.

Cadillac, Mich.—The contract for paving Mitchell-st. with bitulithic pavement has been awarded to the Central Bitulithic Co. of Detroit.

Richmond, Ind.—A declaratory resolution has been passed for building a cement walk on both sides of W. Main-st. and the south side of Kinsey-st.

Milwaukee, Wis.—Sealed bids are asked until April 2 for building sewers in the eastern and western districts. Chas. J. Poetsch, chm. B. P. W.

Edwardsville, Ill.—Sealed bids are asked until April 4 for constructing a sewerage system, with manholes, catch basins and appurtenances. H. P. Hotz, prest. bd. local impts.

Covington, Ky.—An ordinance has been passed for reconstructing Russell-st. from 12th to 15th. Creosoted wood block paving is proposed for Scott-st. from 12th to 18th. Cy. Engr. Gunn.

Houghton, Mich.—Bids for paving Sheldon-st. from Dacotah to Franklin-sts. will be received April 11, with creosoted wood blocks, vitrified brick or other paving, according to local press reports. Vil. Engr. Savicki.

Findlay, O.—The city engineer has been directed to prepare plans and specifica-

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MUNICIPAL ENGINEERING

VOLUME XXVI MAY, NINETEEN HUNDRED FOUR NUMBER FIVE

MODERN METHODS IN ASPHALT PAVING.

By F. O. Blake, Cincinnati, O.

Nothing is more important for an asphalt pavement than proper appliances for refining the asphalt, melting the asphalt, heating the sand and mixing them. Thus far asphalt refining and mixing plants have been planned and built by mechanical engineers having but little accurate knowledge of asphalt. Steam has been used for melting the asphalt for several years, but sand is still heated with a direct fire.

Dr. De Smedt earned the title of "Father of American Sheet Asphalt Pavement." He made certain determinations which form the basis for the scientific deve'opments that have followed. He determinied that it is the petrolene contents of asphalt which give to it the cementitious quality so essential to a successful pavement, and to its asphaltine contents is chargeable the hard brittle condition that causes the pavement to crack, be brittle and wear away. Others have detrmined the character of the petrolene contents of the various kinds of asphalt, that some petrolene is volatile and others fixed. It has been determined that all petrolene will convert into asphaltine when subjected to heat. That is to say, it will lose its tough rubber-like character and become friable and resinous.

Means have been found and appliances invented to make physical tests to determine the converting point of the different bitumens and it is now possible to determine the degree of heat that can be safely employed in refining and mixing asphalt for paving purposes. When it is understood that the converting point of some asphalt is as low as 350 deg. F., and that of the asphalt having the highest fixed character is but 740 deg. F., then it is easy to understand the effect of using a flame varying from 1,100 deg. F. to 2,200 deg. F. in melting the asphalt or in heating the sand to be mixed with it.

The presence of holes here and there in an asphalt pavement, with the other parts of the pavement good, can be explained by one familiar with this proposition. The object that all asphalt experts have had in view has been to produce a mixture having the consistency of lead, both summer and winter, one that would dent slightly when struck a blow with a hammer or with a horse's hoof, for a pavement having this quality will not wear away so long as it retains this malleable condition. This result has been frequently obtained, but rarely twice in succession, even with the same material, treated as nearly alike as the appliances used would permit.

It is evident that the mechanical engineer who plans and constructs a plant for refining, melting and mixing asphalt for paving purposes, must have some accurate technical knowledge of asphalt and know the degrees of heat that can be employed in order to obtain the desired result. No heat should be employed in any branch of the work in excess of the converting point of the asphalt used; if the asphalt used is light and volitile, having a converting point of 350 degrees F., then the heat employed to melt it and to heat the sand to be mixed with it should not be in excess of 350 deg. F.

Sand may be heated by the method now commonly used, with direct heat, and the body of the sand show a temperature of about 300 degrees F, but some portion of it will be 800 degrees F. It may be but a small amount, but whatever it is will develop a defect in the pavement in proportion to the amount over-heated. If uniform good results are to be had in asphalt pavements, uniform material, methods and appliances must be used. Do away with direct heat, temper it to the degree that is safe to use, and the result will be uniform; it will then be possible to lay an asphalt pavement

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twice alike and one that will last very much longer than those laid under existing conditions.

Prof. Dow, of Washington, D. C., in a recent article on asphalt pavements, says in substance, that little progress has been made in the art of asphalt paving, that the early asphalt pavements were equal to those laid of recent date. He might have gone further and said that in many cases they were superior. The old saw "Competition is the life of trade" has not proven true in the asphalt paving business, for it has nearly ruined the business. The demand has been for cheap work and the demand has been supplied. The contractor who could use the least expensive material, or could adulterate the most, use the least asphalt, could do the work for the least cost, was generally the successful bidder. His bond was relied upon more that the specification, with the result that the pavement went to pieces and the bond was not found a good substitute for a good pavement.

Twenty years ago the property owner paid from $3.00 to $4.00 per square yard for asphalt pavement, a great deal of which is still in use and in good condition. Today asphalt pavement is had for from $1.00 to $2.25 per square yard, and it is common to have it go to pieces in a few months. In one case of this kind, a street was laid with the leading standard asphalt, under the management of the best so called asphalt expert skill, but when it was barely ninety days old it called for repairs and gave evidence of short life. The quality of the material, the skill smployed and the integrity of the contractor are elements and conditions precedent to a successful pavement. The absence of either is fatal to the pavement.

The paving business is governed by the same business principles as other lines, and when you expect to get an asphalt pavement for less than its legitimate cost plus a reasonable profit, you are likely to be disappointed. Asphalt paving contractors have learned to lay as cheap a pavement as you want, and as a rule you get a.. you pay for. Probably more asphalt contractors have gone to the wall during the past few years than any other class of contractors; certainly as much money has been lost as in any one line.

One of the worst features of the asphalt paving business is that men have learned to lay a cheap pavement; that is to say, they have learned to adulterate. Having the knowledge, there is always a temptation to use it, especially when the price paid is a little shy. It is difficult to draw a specification and enforce it that will give the desired result. Possibly the system now commonly in use in America for doing such work is wrong. To pay for work by the square yard is to make it to the interest of the contractor to stretch out his material to its utmost. Municipal ownership or control is a possible solution of the problem. Let the city purchase the material known to give the best result and employ skilled labor to mix and lay its pavements and the best possible results will be had.

Glasgow, Scotland, and other foreign cities have their municipal paving plants and get the best results. Why can't we do as well? The argument advanced against municipal ownership or control of public utilities is a reflection against our integrity and ability. No American will ever admt that we are less able or honest than the Scotch or any other nation. When an American once learns what he wants, he is not slow in acquiring it.

REFILLING OF TRENCHES.

By Ernest McCullough, Engineer Municipal Engineering and Contracting Co., Chicago, Ill.

Engineers have not yet arrived at a general method of specifying the refilling of trenches. The writer has read the following requirements in several sets of tractor finds them when commencing work. This clause is generally inserted even when the manner of refilling is specified.

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three feet above the pipe, fill the trench to the top with water and put in the remainder of the material. This is the only proper method for sand and gravel, but an improper method for clay or any earth containing much clay.

4. The trenches shall be refilled and then flushed by the city employes, or by the contractor, in order to settle the trenches.

In specifications like the first and second it is sometimes required that the filling be put in dry or nothing is said about its condition. Sometimes it is required that the earth be moistened as it is deposited and occasionally it is required to be moistened on the bank before it is shoveled in and tamped. When the prescription of method is followed by the rider that the streets be restored to their former conditions, the contractor is put at a disadvantage, because the method specified may be one that is not suited to the material and it is impossible to restore the streets. When this is coupled with a provision that the contractor shall maintain the streets for twelve months from the date of acceptance, the injustice is extended beyond the contractor to the property-owners who pay for the work.

The first method, simply requiring the trenches to be refilled and that the contractor put the streets in as good condition as before he touched them, should serve all purposes.

A clause leaving it to the engineer to specify either tamping or flushing is leaving the contractor in a bad place, for sometimes a change of engineers is made and while the first is satisfied with flushing the latter may insist upon tamping. The bids are uneven on such a job.

The writer after an extended experience in such work gives it as his opinion that, if there is a requirement that all the dirt possible be put back in the trenches and in addition the streets put in as good condition as he found them, a contractor can neglect the specifications requiring him to do the work in a certain manner or to follow a method required by the engineer. Results, not methods, are wanted by the property-owners and the sooner engineers generally realize this the sooner unequal and uneven bidding will stop. It may be stated as an axiom that, when the depth of a trench is equal to or exceeds ten times the diameter of the pipe, no surplus dirt remains to be hauled away, except in some kinds of clay when the ditches have been excavated in rainy weather.

The writer lately personally superintended the refilling of a lot of house connection trenches. The dirt was shoveled in and tamped with a two-by-four stick until the pipe was covered a few inches. Then the dirt was shoveled in loose for about one foot in depth. A hose was played gently on it until water stood over the filling. Dry dirt to the depth of a foot or more was thrown in, when men could go over it with tampers and force it into the mud below until all the earth was soft mud. More dry dirt was thrown in and tamped until it was solid. Then water was run in again until the trench was soft, when more dry dirt was thrown in and tamped. The men got very little mud on their feet. We found that with six-inch pipes in trenches five feet deep and filled in this manner there was often not enough dirt to completely refill the trench. After the foreman in charge had filled a few he was able to gauge the wetting and tamping so the trenches were completly refilled with the dirt taken out. No depression was left and there was no surplus dirt to take away.

In refilling larger trenches in streets the method of shovelling and tamping is more honored in the breach than the observance. The principal injury is to the property owners, if the contractor gets a fair price for such work, as it increases the cost unduly. The property owners also object, as the method is slow and in these days of machinery they like to see the contractors get off a street quickly.

To refill a trench in clay soil after first putting in water is apt to be bad. The writer has in mind one piece of work done within the past year where that method was specified, and even when the season was rainy it was insisted upon. On one street so many teams stalled that the writer after four months had the trench dug out to a depth of four feet and refilled with absolutely dry dirt, because the specifications also required the restoration of the streets.

The method of refilling by any old method and then flushing to settle the trenches is often slighted. Left to a lot of ignorant, unthinking laborers the method adopted is to push a hose clear down until it touches the pipe, turn the water on and go off to the nearest shady spot and sit down for awhile. Of course the trench goes down, but future house connection work reveals queer looking lines of pipes with joints washed out and damaged stoppers in wyes.

The writer begs to offer the following specification for the consideration of engineers in charge of such work.

"After the pipe is laid the earth shall be shoveled back and tamped with a two-by-four tamper in a manner that will not disturb the grade or alignment until

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there is about one foot of earth over the pipes. The contractor shall then refill the trenches with all the earth excavated therefrom, mounding up the excess. Along the trench on top of the mound a ditch shall be made, and at intervals of about twenty-five feet holes shall be dug two or three feet deep. A stream of water from the nearest hydrant shall be turned into the upper end of the trench gently, so it will flow without washing out the earth and gullying it. This stream shall run until the earth shows signs of practical saturation, when it shall be stopped. For this water a charge will be made of 20 cents for each one hundred cubic yards of earth in the trench. As soon as practicable the contractor shall roll the trench with a roller of not less than five tons weight and scrape dirt from the sides over the settled part and alternately scrape and roll until the trench is settled as much as possible. If the excess earth is still heaped high, another ditch shall be run full of water over it and the dirt alternately rolled and scraped until the earth over the trench is neatly rounded, and the height in inches above the general street level is equal to the width of the trench in feet. No surplus dirt shall be hauled off the street except upon a written order from the engineer in charge.

"If the trenches are excavated in earth containing at least 50 per cent of sand or gravel the trenches shall be refilled, after the first foot is deposited, and tamped by filling the trench for half its depth with water and then putting in the remainder of the excavated material. The rolling and scraping shall not be omitted in any trench.

"In trenches containing a large proportion of stone the first foot shall be of earth or sand and the stone in the remainder of the trench shall be so mixed with earth or sand that there shall be a minimum of voids. No stone or gravel shall be permitted to touch the pipe.

"All ditches in earth not parallel with the line of travel on the street to be filled as follows: The earth to be filled over the pipe to the depth of about one foot if round to be not more than six inches in diameter. No ditches permitted to be filled with dry earth and tamped without the addition of water before the tamping, as specified."

With a specification like the above there is no need of requiring the contractor to put the streets in their former condition. What that condition was is too often a matter of controversy. The writer one time had certified copies of all complaints of the condition of certain streets made before entering upon the work of trenching in them. These letters were addressed to the Street Commissioner before the contract was advertised and were from angry property owners who thought he was neglecting his duty. According to these letters wagons were continually breaking down and there were quagmires and ruts of dangerous dimensions existing therein. As a matter of fact the streets were in mid-ning fair condition. During the progress of the work and upon its completion the contractors were blamed for the poor condition of the streets, and to judge from the letters then sent in they had been first-class in every particular before the contract was let.

There was difficulty about getting a settlement after the work was done on account of the complaints about the way the contractor treated the streets. The certified copies of the letters—many written by the same complainants—were attached to a peremptory demand from the contractors for a settlement, as showing the actual condition before the work was done. As these letters might be good evidence in absence of better proof the settlement was made. The contractor did not in any place leave the streets in as poor condition as the exaggerated complaining letters would indicate had been their condition before he touched them.

One of the best methods for filling in hand dug trenches is to scrape across with a long rope. A good team with a driver and one scraper holder should do five yards an hour. That is, the contractor's team can do this. Hired teams col-

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to refill trenches. It is set at one end of the street and a cable is run alongside the trench to a pulley fastened to tree (first wrapped with canvas or burlap to avoid chafing) or to posts. From this pulley the cable goes across the trench and is fastened to the scraper, which is larger and heavier than an ordinary "slusher," and has ropes fastened to the handles, by means of which two men haul it back and turn it over. This requires an engineer who does his own firing, at the block a boy to signal him, and the two scraper holders. The total cost for labor, fuel, etc., is about ten dollars per day, which includes interest and depreciation. One hundred yards per day is all that can be figured on steadily on an average, so that the cost will be ten cents per yard. One hundred and twenty yards per day will make the scraper holders quit the job. By adding two more scraper holders and working the men in ten or fifteen minutes shifts, as much as two hundred and twenty-five yards have been put into a trench in ten hours. The writer has found it almost necessary to have an old horse to pull the cable back as the men haul back the scraper or else have a double cable and a tackle. When the horse is used the signal boy rides him. The increase in expense is not great and it lightens the work of the scraper holders.

Another method used successfully on unimproved streets in a light soil is to plow from one end of the ditch to the other, gradually extending the work to the outside edge of the piles of dirt and using a plow with a large mold. Each round loosens the dirt and throws it towards the ditch. Plowing is fast work and after the whole of the excavated earth has been plowed the street looks fairly level and a road grader can be used to good advantage in connection with a road roller, alternately scraping and rolling. There is no cheaper way of filling a ditch if the engineer in charge will permit.

In a town or city where the unions are in control such results cannot be readily obtained by horses and scrapers, if wages are $5 per day for team and driver. The writer likes then to sublet the work by stations to non-union men with pick and shovel. The back filling can be done at a cost of 15 to 22 cents per yard by hand. If teams can be readily obtained it is well to insist upon fifty yards per day as a minimum and set two marks for the men to work between. That is, set two stakes on the bank which contain just fifty yards as shown by the cut alongside and insist upon that as a day's work. If the men get an idea in their head that such a length is a day's work they have sometimes finished earlier and are let go. After a few of them have shortened their time that way it is not hard to keep them up to it. But a contractor should invariably own his teams.

PLANS FOR CHICAGO PARK EXTENSION.

By C. B. Maugham, Chicago, Ill.

Under the leadership of a young "man on horseback." Chicago is planning a system of wooded reserves and connecting parkways to engirdle the city and provide adequate recreation area for a population of upward of 5,000,000 souls. The man is Henry G. Foreman, who is president of the Board of Commissioners of Cook County and also of the South Park Commissioners. In this dual capacity he is both constructing and planning parks.

As president of the South Park Commissioners he is working out the problem of establishing new parks and improving old ones in population centers of the South Division of Chicago. Olmstead Brothers are now making landscape plans for Grant Park and Mr. Marshall Field has agreed to erect therein a $6,000,000, white granite museum building.

As president of the board of commissioners of Cook county Mr. Foreman is oiling the machinery necessary for the construction of the system of forest preserves and parkways, which will supplement and connect with the intra-mural system.

To understand the park situation in Chicago today it is necessary to go into the history of park building beginning with the great movement of 1869, when the present, or inner belt, system of parks and boulevards was begun. At that time Chicago had a population, of about 250,000, and in the number of its inhabitants was the fifth city of the Union. Owing to limited means of transportation, the population was located chiefly within a radius of three miles of the courthouse.

Many of the parks laid out were in the midst of truck gardens, and there were

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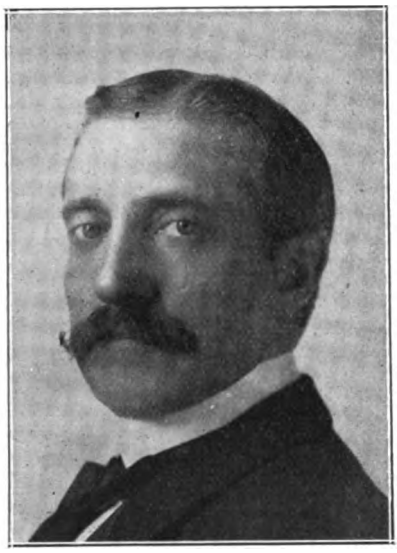
persons who ridiculed the proposed system as a dream impossible of practical results. However, by the extension of street car lines, the parks have become centers of residence districts, and, now, a little more than thirty years after the plan was conceived, the breathing places are inadequate to the needs of the people. Thus the wisdom of the projectors of that park system has been shown by the actual growth and needs of the community.

The park system as planned in 1869 put Chicago's recreation area on a practical level with that of Philadelphia, then the city having the largest acre area of park of any city in the United States. But in



HENRY G. FOREMAN,
President South Park Commission.

1902 Chicago's population had grown to more than 2,000,000, and the city in this respect had stood for many years second only to New York; yet in the acre area of its parks it had slipped back to the sixth

caused a great advance in park-building in Chicago.

The South Park Commissioners now are giving attention to the needs of its population centers, remote from parks. Lincoln Park, in the North Division, is to have a larger addition to the northward. The Special Parks Commission, acting with authority from the City Council, has recommended to the three Park Boards of Chicago sites for small parks. The additions to the South Park system will aggregate about 450 acres, and the addition to Lincoln Park, 235 acres. The sites for small parks, as recommended, aggregate 43 acres for the South Division, 28 acres for the West Division, and 15 acres for the North Division, which, in round numbers, would make, including present parks, the total acreage in the South Division a little more than 2,000, in the North Division about 540, and in the West Division a little more than 1,000 acres, or, for the entire city of Chicago, about 3,800 acres. Even with these addition, Chicago will be far behind New York, Boston (including its outer belt) and Philadelphia in park area.

The following table, based on the Federal census of 1900 for population, and the Federal labor report of 1902 for park and city area, shows Chicago position:

Order. City.	Population.	Area in Acres.	Park Area in Acres.
1—New York.....	3,437,202	*209,218	6,838
2—Philadelphia	1,293,697	84,933	4,006
3—Los Angeles	102,479	27,697	3,720
4—Washington	278,718	44,320	3,596
5—San Francisco .	342,782	77,520	2,804
6—Boston	560,892	27,251	2,620
7—Lynn, Mass. ...	68,513	7,251	2,464
8—Chicago	1,698,575	122,240	2,185
9—St. Louis	575,238	39,277	2,183

* Land area only.

In the number of inhabitants to each acre of park, Chicago is number 32. Los Angeles is number 1, with one acre for every 27.5 inhabitants. Chicago is number 32, with ine acre for every 789.4 inhabitants. Between are the cities of New Haven, Columbus, Toledo, Denver, Rochester, Detroit, Buffalo, Pittsburg, Milwaukee, etc.

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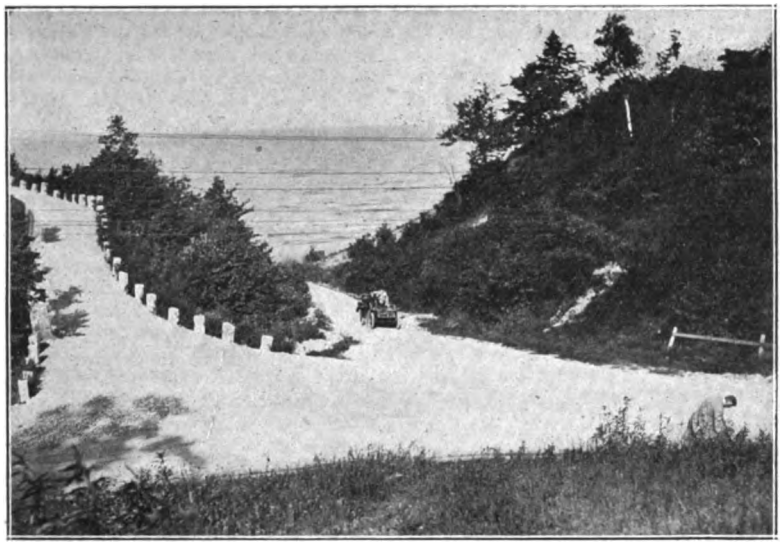
figure, which, within a few years, will increase very perceptibly in value. Furthermore, if they are not secured now or soon, city life will be extended into them. They will be parceled into subdivisions; they will be cut into lots and streets; they will be supplied with sewers. The forests will disappear, and the art of man never will be able to re-create them."

Recognizing the necessity of taking action the Board of Commissioners of Cook County on Aug. 3 last, acting upon a message from President Foreman, adopted a resolution for the creation of an outer belt of parks and boulevards.



DEAD MAN'S CURVE, SHERIDAN ROAD, NEAR GLENCOE.

The commission to do this work is composed of twenty-nine members, including the president and four members of the County Board, the Mayor and four members of the City Council, three members of Lincoln Park Board, three West Chicago Park Commissioners, three South Park Commissioners, five citizens of Chicago and five residents of Cook County,

around the city of Chicago, embracing the valleys of nearby rivers and creeks—such as the Calumet and Desplaines Rivers and Salt Creek—and parts of the Lake Michigan shore. It would take in forest tracts of several thousand acres each. These forest tracts would be preserved for all time in their native state. The roadways would be improved into fine roads for driving and automobiling; there would be police patrols and a fire brigade specially instructed to suppress forest fires. Such outer belt would be perhaps from 80 to 150 or even more miles in length. It would not simply be a belt sweeping around the city, but there would be points where two or more diverging roads between given places wou'd be located, so that a traveler could have the alternative of which road he would take, and be assured of a good road all the way.

Not one in 10,000 of the population of Chicago knows the beauty of the country that lies round about the flat and smoky city. To the south there are low, marshy

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on top of the divide in any direction a beautiful and expansive view of the surrounding country is afforded.

Once over the divide, the parkways would cross the great drainage canal, one of the engineering feats of the century. Then they would turn into the picturesque valley of the Desplaines River, where beautiful forests still are standing.

In these forests are many small wild animals. The inroads of civilization have not exterminated the wild flowers and ferns, there are large and ancient trees of many varieties, and those that fringe the river bank are festooned with wild grape vines and the emerald billows of the wild cucumber. These forests are within easy reach of Chicago and extend along its western limits. To the northwest is the big skokie marsh, affording expanses of green studded with groves of trees. To the north is the shore of Lake Michigan, a series of bluffs and wooded ravines.

Already over much of the territory which the outer belt of parks and boulevards will embrace there is a network of hard white roadways that will need only widening and policing to make them serviceable for boulevard purposes.

Among the cities and towns through which the outer belt probably will pass are Pullman, Riverdale, Blue Island, Willow Springs, La Grange, Lyons, Riverside, Oak Park, Maywood, River, Forest, Desplaines, Wheeling, Glencoe, Winnetka, Wilmette, Evanston and Rogers Park.

When the pioneers first came to America, it was absolutely necessary for them, in making settlements and in conducting the activities of their primitive life, to cut down forests. They and later generations did the clearing business too thoroughly. Today it is just as necessary to preserve the few forests that are left and in every way protect them from devastation, as it was for the pioneers to hew down the trees. This is recognized as a matter of greatest importance by the United States Government, which has a Forestry Department, and is teaching those who will learn how to save forests. In fact, a new occupation in life has been created for many people in the scientific study of forestry. The other day a man handed President Foreman his card and on it was written "Expert Dendrologist." He was a tree expert. This is a very significant fact.

COST OF HOUSE PLASTERING.

By R. L. Brooker, Akron, O.

The accompanying table is taken from our plastering business the past season and gives the amount and cost of labor and material for plastering seventeen houses, that run from 500 to 1,000 yards. These are taken at random and the table not only itemizes every part of the work, but shows how local conditions will af-

COST OF HOUSE PLASTERING.

House No.	Lathing, per yd.	Lath and Nails, per yd.	Bunches required to cover 100 yds.	Labor putting on 1st coat of mortar, per yd.	Material for 1st coat of mortar, per yd.	No. sacks required to cover 100 yds.	Labor, putting on whitecoat, per yd.	Material for whitecoat, per yd.	No. of yds. covered by 100 lbs. whitecoat material.	No. of yds. covered in 1 hr. by 1 man, 1st coat.	No. of yds. covered in 1 hr. by 1 man, whitecoating.	Entire cost per yd., labor and material.
		c		c	c		c	c				c
1	2¼ +	6½ +	26	3⅜	3½	6	3⅜	1 —	60	21	18	20
2	2½ +	6¼	25	4 +	4⅜	8⅝	2¾	1 —	70	15⅛	20¼	20½ +
3	3 —	6½ —	25⅛	4	3¼	5⅝	3 —	1 —	67	17	20¾	20½
4	3 —	6¾	27	3⅝	3¼	6 +	2⅝	1 —	73	17	18¾	20
5	3 —	6⅜	26	4½ —	4½	7¼	3	1 —	67½	14½	18	22
6	3 +	7 —	28	4 +	3⅜	7	3¼ —	1 —	65	15¾	17¾	22

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fect the cost of a job. These houses are all done in the same way and nearly all with the same material, yet there is a variation of 2½c in the entire cost of these jobs.

The work is what is known as "three-coat" work—the first and second coats being applied at the same time and consisting of the same material, while the third or whitecoat is not applied until the first and second coats are thoroughly dry. The brown wall, consisting of the first and second coats, is roded along angles and base, then darbied, and finally just before taking a set is floated to an even surface ready for the whitecoat, when dry. Having this even surface, the whitecoat can be applied very thin and even and when troweled down produces a smooth, hard wall and a first class job in every particular.

A custom prevalent in cities is to spend less time on the brown wall leaving it rough and without being roded, and then apply a heavy whitecoat, straightening the walls and angles. to some extent, with this material.

The material used for the brown wall was, in most cases, "Alabastine," put up in bags of 100 pounds each of neat material. Sand was added to this in the proportion of two parts to one part Alabastine. For whitecoating the prepared whitecoat material known as "White-Enamel Finish" was used.

The only item of expense entering into a job not included in this table is the draying of boxes and tools but this in no case amounted to over a small fraction of one cent per yard.

CONDUITS FOR ELECTRIC WIRES.

The danger to life and property from overhead wires is not yet sufficiently demonstrated in many smaller cities to force the construction of underground conduits. The danger appears in several different forms. So long as the number of wires strung overhead is small and the tension of the electricity is low, the danger is limited to the delay in cutting the wires to get at a fire in an adjoining building, but even before the general distribution of electric light and power from central stations the telegraph and telephone wires became so numerous in the larger cities that cables, overhead or in conduits, were demanded. When the high tension wires were introduced new elements of danger presented themselves. A break in such a wire or even in its insulation is a source of danger to life and property on the spot, or at widely distributed places through contact with other wires. The danger in getting at fires is also greatly increased. The destruction of wires and poles in storms has added to the loss of property and business of the companies owning the wires, the greater dangers to other people and their property through the massing and crossing of wires with various volumes and tensions of current.

These and other similar sources of loss and danger have forced the construction of conduits in the more congested districts of the larger cities, and as the benefits of the removal of the wires from overhead have been demonstrated, methods of construction have been improved and cost has been reduced, the use of conduits has spread in those cities and has been introduced in smaller cities. There is still room for improvement and many cities need only full information to join the ranks of those requiring some sort of underground construction for carrying wires, or, as a steppingstone thereto, aerial cables for wires for which this method of construction is suitable.

Operators of telephone, telegraph, electric light and power systems who have enjoyed the advantages of subways for their wires have learned that aside from a matter of safety to the public it is to their financial interest to put wires and cables underground. The higher first cost of installation is more than compensated by the great reduction in annual outlay for repairs and maintenance of distributing system, the safety of station apparatus and the gain which comes from less frequent interruptions to service. These savings and gains pay a handsome income on the increased investment.

In addition to the advantages mentioned, new corporations are finding that they can often obtain franchises for telephone and lighting systems by offering to put their wires underground where otherwise the desired franchise could not be obtained. This concession is rightly looked upon as a moderate one for so great a return, if indeed it be a concession at all in the face of the advantages and savings already mentioned.

Furthermore, street space for under-

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ground work in any city is limited, and in some cases is already largely occupied by sewer systems, water systems, gas mains, etc., hence each additional underground system is installed at greater inconvenience and expense than that which preceded it. The established corporation must therefore construct subways for its wires not only to save operating expense and improve its service, but as an additional safeguard against competition from new companies.

The early constructions covered the telegraph and telephone wires with rubber, jute and lead and laid them underground. Rapid deterioration, difficulty in locating leaks and in making repairs soon led to the use of ducts through which insulated cables could be drawn. These ducts have been made of pump logs and wood in various forms, creosoted or in the natural state, heavy iron pipe, wrought iron pipe protected by a cement mortar coating, terra cotta tiles, hollow brick, vitrified clay conduits, single and multiple duct, bituminized fiber and other materials, the object being to secure a conduit which shall be electrolysis proof, non-abrasive, both conduit and joints moisture proof, non-corrosive, non-decaying, with high insulating quality, and at the same time reasonable in cost and economical in maintenance. Other qualities desired by the constructors are self-aligning joints, which shall be permanent in their alignment, light weight on account of freight, hauling, handling and laying, strength and toughness to stand handling, long sections to reduce the number of joints.

These qualities of conduit material and conduit, of first cost, cost of maintenance, convenience and appearance are approximated more or less closely by the various systems and materials for conduit construction on the market and a selection must be made for the particular problem on hand after a consideration of all these elements.

The various methods and materials will be described and illustrated in this and subsequent numbers of Municipal Engineering, since the rapid extension in the use of conduit construction makes the subject one of increasing interest to many of our readers.

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EDITORIAL COMMENT

Concrete Block Architecture.

Asphalt and Automobiles.

Rights and Duties of the Washington Inspector of Asphalt and Cements.

CONCRETE BLOCK ARCHITECTURE.

An inquiry from a subscriber for plans for houses to be built of concrete blocks prompts some suggestions regarding the proper treatment of this new building material, which seem to be greatly needed if the business is to have its fullest development in all directions.

The new material, if the blocks are properly made of first-class cement and stone or gravel to suit the appearance desired, is capable of the highest artistic development and can be used in the most correct architectural compositions. That it has not been so used more generally and that its use in the better class of buildings has even been prevented in some cities is due not to the material but to the manner in which it has been introduced in those cities and the lack of architectural or artistic ability of the operators of the local plants. That first-class work of the best appearance and architectural effect can be done is shown by buildings and trimmings of buildings in Washington, New York, Cleveland and other cities where the blocks have been made and placed under the specifications and supervision of competent architects.

In too many cases the machines or rights to use processes have fallen into the hands of men who have been attracted by the cheapness and the strength of the method of construction, and in their haste to get to work they have begun by supplying blocks for foundations and for small dwellings and business buildings which would otherwise have been cheap brick or frame structures. In the struggle for cheapness, and frequently on account of lack of knowledge of cement and its use, blocks have been turned out which are not satisfactory for any higher uses

A man interested in cement construction proposed to build a two-story frame house, but found on inquiry that he could build it of cement blocks at practically the same cost. Without change in plans, in fact, without any definite architect's plans, he proceeded to lay up the walls with cement blocks. Since blocks are much larger than bricks it very naturally happened that at each angle or offset in the walls there was a space less than a block in length, which must be filled in with a fractional block, which was carelessly cut and fitted, showing clearly the lack of design. Instead of making window and door frames to fit the depth of block courses, or changing the depth of blocks to suit the frames, a string course was run to fill in the two or three-inch gap and the blocks above and below the frames were notched roughly to let them in. The result is a house of fair appearance at a distance, but a patchwork on close inspection. This may be an extreme case, but it serves as an illustration of what is actually occurring in many places. The effect is to restrict the use of blocks to foundations and the cheapest constructions and to cut them out of consideration for first-class work except by the few who know what can be accomplished and are willing to pay what the work is worth.

Ability to compete with common brickwork in cost seems to have obscured the fact that a block a little higher-priced because better and more carefully made, can compete still more successfully with fine brick and stonework. More effort is necessary to get a footing in this higher class of work, but it is worth much more when it is obtained, and the cheaper work will then come without effort.

There is plenty of business in the

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ASPHALT AND AUTOMOBILES.

A recent article in one of the trade journals strongly advocated asphalt paving upon city streets as best for automobiles. Another trade journal agrees that when dry it affords good traction and satisfactory traveling, but claims that asphalt is seldom dry on account of the sprinkling carts which patrol city streets continuously in some cities during most of the months of the year. When wet, this journal claims, there is nothing so treacherous as asphalt, side-slipping, skidding at corners and sliding down grades making the machine dangerous both to operator and to general traffic. A sudden stop from any speed called moderate or above is prevented by the sliding of the wheels under the momentum of the heavy vehicle. The same is said to be true of a wet wooden block street.

A brick street or a bituminous macadam street would not be open to this complaint. There is sufficient grit upon the surface of smooth streets paved with either of these materials to hold a machine from slipping.

This magazine may be permitted to suggest that asphalt is a very good pavement for automobiles for the reason for which objection is made to it by the second journal referred to. If the operator is continuously in danger of slipping at moderate speed he will be much more careful to travel at reasonable speed than he is when he feels more sure of his ground, and thus one of the terrors of pedestrians, especially women and children, will be lessened. Let us have more slippery streets if they will tone down the speed of the automobilists on the city's pavements.

RIGHTS AND DUTIES OF THE WASHINGTON INSPECTOR OF ASPHALTS AND CEMENTS.

The amendment made in the United States Senate to the bill appropriating funds for public work in the District of Columbia whereby it is provided "that said inspector of asphalt and cement shall not render expert advice to or perform service for or receive or accept

ample of the scientific method as applied to public affairs. Its investigations have produced results which are taken as standards by the other cities of the country. In particular, its work in paving materials, and especially asphalt, has been of inestimable value in the development of the use of various substances. The successive heads of the department having charge of the inspection and investigation of these materials have been men of pronounced ability, who have been men of reputation or who soon developed a reputation for originality and stability through the unassailable character of the results published by them, which has given all their utterances an authority which is generally recognized. The mistakes made by them have been so few and so unimportant as to have no material effect upon the general opinion of their ability and their honesty and absence of bias or susceptibility to undue influence. The present incumbent of the office is no exception to this rule.

All of these inspectors have been permitted to perform occasional service for other persons, firms, corporations, and municipalities, which did not interfere with their duties to the city of Washington. In fact, it has been generally understood that much of this work has been encouraged by the engineer commissioners for many years. It is natural that the commissioners should look with favor upon some such outside work, for it results in material benefit to the department. Person desiring to develop new materials and methods much prefer competent investigators who are removed beyond the possibility of outside influences and whose regular work keeps them always in full knowledge of the latest improvements. Cities to which new methods and materials are offered are still more anxious to secure the services of such persons in testing the claims of the promoters of such improvements.

The amount of such work in the past has been so slight or so unevenly distributed that it is not surprising to find that practically all the competent men of experience in these lines are or have been in the employ of the promoters of various

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Columbia. Particularly to the cities of the country, therefore, it will be a misfortune to be cut off from the services of this person.

The restriction of the inspector to his employment by the District may be successfully defended if he is given sufficient salary to retain the services of fully competent men such as those who have been obtainable under the system heretofore in operation. In that case it should be possible for the department to accept many such commissions as the inspector has heretofore filled in his private capacity, the fees for the same being turned into the funds for the support of the office. So far as work for other municipalities is concerned, the District, from its commanding position, more independent of political and business influences than any other city in the country, is in position to give invaluable service not elsewhere obtainable. It has a moral obligation to furnish this service, and if the inspector is prohibited from giving it in a private capacity, the engineering department should arrange to perform it officially. There are difficulties in this method of offering the service, including the increase in the salary of the inspector, which do not appear under the method of doing business heretofore in vogue, so that the change will be very unsatisfactory to all concerned.

The reason for the restriction of the work of the inspector has not been generally published and it is human to suspect the motives of those who work secretly to change methods of doing business concerning which there has never been any complaint from those directly interested, nor from any except those whose materials or methods have not stood the tests of the full and unbiased investigations which they have received from this official.

THE QUESTION DEPARTMENT

JOINT FOR SUBMERGED WATER MAIN.

What kind of joint gives the best satisfaction for a water main laid in the river bottom? What would be the probable cost, of laying a 12-inch main the length of 370 feet in water two feet deep, the bottom being rock which can be picked and would need no blasting? If this pipe was laid in the trench and the joints were run with lead and the trench filled with concrete, would there be any danger from expansion and contraction?

J. M. S., Royersford, Pa.

An ordinary lead joint made perfectly water-tight should be entirely satisfactory under the conditions described. If the trench is made with a straight grade on the bottom the pipes can be put together above the water surface and the whole length lowered into place at once. The expense will not probably be greater than that of laying a pipe in a rock trench on shore, the less depth of excava-

as it would depend almost entirely upon the temperature of the water in the pipe. The depth of trench under the river should be sufficient to prevent freezing under the conditions in the river. The pipe should be tested for leaks before the concrete is filled into the trench.

FIRE HYDRANT RENTALS AND SERVICES.

I noticed in a copy of your magazine an article prepared from a thesis on fire hydrant rentals and services to which I would like to refer, but do not know in what number it appeared.

S. C. ROWLAND,
Crawfordsville, Ind.

The article in question was on "Hydrant Rentals" and was from a thesis by D. H. Sawyer. It appeared in March, 1903, vol. xxiv, p. 182 of Municipal Engineering. An editorial giving some

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pressions of desire for an index and if some more can be obtained from persons, like this subscriber, who wish to refer to special articles on particular subjects, the editor's index will be prepared for publication.

LIABILITY OF WATER COMPANY FOR FIRE LOSS.

In your last issue you mention a decision by a California court involving the liability of a company furnishing water supply to a suit for damages in case the supply or pressure be inadequate. Will you kindly give something of the details of this case, or where they can be found?

JOHN P. BROOKS,
Lexington, Ky.

The case referred to is that of the Town of Ukiah City (Cal.) vs. Ukiah Water and Improvement Co., reported in vol. xxvi., p. 250 of Municipal Engineering. The decision of the lower court awarding damages to the town for failure of the company to supply water to extinguish a fire which damaged city property was reported in Municipal Engineering, vol. xix., p. 418. The water company moved for a new trial, the motion was granted and the town appealed to the Supreme Court from this order. A full report of the decision of the Supreme Court on Feb. 10, 1904, affirming the order granting a new trial, will be found in the "Pacific Reporter," vol. 75, p. 773, March 28, 1904.

The decision recites that the water company had been engaged in furnishing water to the town and its inhabitants; that the town owned the fire hydrants, to which the company furnished water at a stipulated price of $1 a month for each hydrant, which was paid by the town, these being practically the only points of evidence of contract between town and company. It then says:

"The mere fact that a corporation was engaged in the business of furnishing water appropriated for sale, rental and distribution would not place upon it the obligation of having constantly on hand a sufficient quantity of water available for use by the town for the extinguishment of fires, for the failure to observe which it would be liable to the municipality for the value of municipal property destroyed by reason of such failure."

A contract for fire service is definitely stated to exist, though there is no written contract, and if this be so it was available at the various hydrants. "The town entered into the agreement under its power to provide protection against fire for all its inhabitants, exercising the same character of functions that it does when it provides fire engines or policemen." Many cases are cited in which it has been decided that a town owning its own water works is not liable to its citizens for failure to provide an adequate supply, the city's power being legislative and governmental, requiring the exercise of judgment and discretion. Many other cases are cited in which it has been decided that, when a town contracts with a water company to furnish such service, practically as the agent or employe of the city, the water company is not liable at the suit of a third person whose property was destroyed by fire, by reason of its failure to supply sufficient water to the town for such purpose, the contracting company not being chargeable with a greater liability than the city itself. Only two cases are cited in which the decisions are otherwise, one in North Carolina following one in Kentucky in which there was a private contract between the company and the consumer.

"Doubtless a water company may so bind itself by contract with a person to furnish him water for the extinguishment of fires as to render itself liable for the value of such property of such person, destroyed by fire by reason of its failure to furnish him a sufficient supply of water." Several cases are cited in confirmation. "It may be assumed here that it is within the power of a municipality, as a property owner, to enter into such a contract with a water company for the protection of the property which it owns as a legal individual; but it certainly needs something more than evidence showing an accepted service for general fire purposes to establish such a contract, and the evidence here shows nothing more."

Several cases of recovery of damages are cited, but are separated from the case under consideration by the fact that there was an express covenant in the contract, which is lacking in this case.

Another case in the South is reported elsewhere in this number and some of the questions involved are discussed in vol. xxvi, p. 23.

PRESSURE OF EARTH ON PIPE IN

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the stresses and distortion due to the weight of the pipe itself? Do you know if any experiments have been made to determine the actual pressure of earth as in the case of a water pipe buried therein?—W. B. M., Ann Arbor, Mich.

Can our readers cite any experiments or discussions which will aid our correspondent?

SPECIFICATIONS FOR CAST IRON PIPE.

Our City Council is about to advertise for bids for about three and one-half miles of fourteen-inch wooden pipe, the same being an additional supply pipe from the reservoir to city, and I have been instructed to draft specifications for same. Will you please inform me where I can obtain a copy of the specifications adopted by the New England Water Works Association, Sept. 10, 1902, for cast iron pipes? C. M. THORPE.
Engineer, Bozeman, Mont.

Mr. Charles W. Sherman, editor of the Journal of the New England Water Works Association, 715 Tremont Temple, Boston, Mass., can supply the specifications in full as they were finally adopted by the society.

STONE DRINKING FOUNTAINS.

Can you cite me to any firm or individual that makes, cuts or manufactures stone drinking fountains?
J. F. S., Noblesville, Ind.

Makers of stone monuments would probably be able to make stone fountains of ordinary design. They can be found in any city of moderate size. Stone carvers are listed in Hendricks' Directory, who might undertake the work, such as A. F. Nygard, 68 Cass-ave., Detroit, Mich.; F. & H. Schroeder, Linn and Betts-sts., Cincinnati, O., and others. Possibly stone-workers, such as the Bedford Cut Stone Company, Bedford Quarries Company and others of Bedford, Ind., could supply simple designs.

MACHINE FOR MAKING CEMENT PIPE.

About a year ago I noticed in your magazine an article treating on the use of cement for water pipes. If I am not mistaken the writer of that article stated that so far nobody es yet had made proper molds suitable for manufacturing cement pipe. Would you kindly advise me if since then any firm makes any form or mold in which cement pipe lengths could be prepared, and, also, if such pipes are now in practical use?
C. T., St. Louis, Mo.

Cement pipe machines are offered by H. Schebye, 348 Carolina-st., Pittsburg, Pa., and a description of the machine will be found in Municipal Engineering, vol. xxvi, p. 65. The Brady Cement Stone Company, Jackson, Mich., and the Cement Machinery and Manufacturing Company, Burlington, Ia., also have machines for making cement pipe. These pipe are not supposed to be subjected to much internal pressure from water, being intended for sewers, culverts or other water not running under pressure. It is not known what pressure they would stand, but it is certainly not that of the usual water supply system. Some reinforcement, such as a welded steel pipe envelope or an internal steel mesh would be necessary if the pipe is to be subjected to pressure, as well as special work at the joints.

CONCRETE WALL FOR WELL—COST OF CONCRETE BLOCKS.

I have a well fifty feet deep. From surface of ground down about thirty feet is very poor dirt, a kind of fine mica, which sloughs off. The next twenty feet is solid granite rock. I want to wall it from and commencing on the rock up to the earth surface with concrete, by making a form the size of well and digging out about six inches around, or would eight inches be better? How would cinders from railroad engines do for the concrete? How much cement and sand would you use with cinders? Would natural cement be strong enough? How long ought concrete to stand before moving form up for another section? I thought of making form about ten or twelve feet high, so as to save moving up so often. Is that too much at one time? Well is now three feet in diameter and will be that when finished with six or eight-inch concrete wall.

How do concrete blocks compare in price with brick in a wall when brick are worth $7.50 per thousand on the ground? About what is the cost of concrete blocks for a twelve-inch wall when made by hand, the sand costing 50 cents a cu. yard and surface flint or quartz rock $1.00 per cu. yd.?
FRANCIS M. LEDBETTER,
Greenville, Ga.

The wall for the well can be made of concrete, preferably of cement, sand and gravel or broken stone in the proportions of about 1, 2½ and 5, or 1, 3 and 6. Cinders are not so strong as gravel or broken stone, and if the soil is bad it would be safer to use the stronger material. Portland cement will be most satisfactory and much more durable than natural cement. The thickness of wall for perfect safety in bad ground should be, say, 12 inches at the bottom, and can be reduced at intervals to 6 inches at top. Three forms, each 4 feet high, will make it possible to

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proceed almost continuously, the lower being removed when it is needed for extending the wall up, the concrete setting in the middle and lower ones as long as possible and the work of excavation and concreting being done before and after the upper form is set. If the ground is very bad more forms and each form one to two feet high may be more convenient and result in less delay from caving.

The relative cost of concrete blocks and brick in wall depends on cost of brick and labor and of cement, sand and gravel. Generally speaking cement blocks can be made and put in wall cheaper than brick with the prices given, but a sharp rise in the price of cement might turn the balance the other way. It is easy to compute the cost of blocks with given cost of materials (cost of cement is omitted in the above statement), provided work is steady and men are well broken in, but the making of small numbers of blocks at irregular intervals is another matter and may greatly increase the average cost of the product. Many of our readers doubtless have much information now upon this question, some of which they may be willing to share with their fellow-subscribers to this magazine.

THE PACIFIC COAST CEMENT COMPANY.

We are quite anxious to obtain some information in regard to the Pacific Coast Cement Company at Vancouver, B. C., as to the character of the cement and the standing of the company.

C., Baltimore, Md.

The second edition of the "Directory of American Cement Industries" states that the offices of the Pacific Coast Cement Company were at 66 Broadway, New York City; that they proposed the erection of a cement plant at Vancouver, B. C., and that a contract for a part of the electrical equipment had been let. No new information has been received for the third edition and letters addressed to the New York office have been returned indorsed "removed and left no address."

THE ALMA CEMENT COMPANY.

Will you kindly send us the names of Wellston, O., to which it has added mines at Oreton, O., on which mills of 8,000 or 9,000 barrels capacity are proposed. The officers of the new company are: B. B. Lathbury, President, Land Title Building, Philadelphia, Pa.; Frederick Strauss, Vice-President; Mark T. Cox, Secretary and Treasurer, and William J. Wilson, Assistant Secretary and Treasurer, all of New York City. William J. Donaldson, Philadelphia, is the general sales agent. This information is taken from the third edition of the "Directory of American Cement Industries" ($5), which is published about the time this number of Municipal Engineering is issued.

SAND FILTERS FOR WATER SUPPLIES.

The city of Waterloo has been having some serious trouble with typhoid fever and thinks its only hope is in a successful filtering plant. Will you kindly give me the names of the cities nearest Waterloo which have sand-bed filtration plants in operation?

P. J. M., Waterloo, Ia.

Sand filtration is not yet in use to any extent in the Western states. Indianapolis is now constructing a sand filtration system. Albany and Poughkeepsie, N. Y., are the nearest plants known to the writer which have been in operation a sufficient length of time to prove their value. Locations of Western plants and descriptions of the same will be published as information regarding them is available.

There are many mechanical filtration plants in use in the West in which sand is the filtering material, most of them giving excellent results. A long list of these can be given if desired.

MAKERS OF TOOLS FOR CEMENT WORKERS.

Will you kindly advise us of the names of manufacturers of tools for cement sidewalks and other cement work of this kind?

J. J. H., Pittsburg, Pa.

Reference may be made to the list under the heading "Tools for Cement Workers" in the "Directory of American Cement Industries" ($5); also to the "Business

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F. H. Crafts, Rochester, N. Y.

Iroquois Iron Works, 178 Walden-ave., Buffalo, N. Y.

Austin-Western Co., Lld., Chicago, Ill., for some such tools.

Julian Scholl & Co., 126 Liberty-st., New York city, have such tools also.

CRACKS IN CONCRETE BLOCKS.

The many instructive articles in the "Municipal Engineering" on Portland cement work of various kinds indicate the thoroughness with which you are dealing with this subject, and prompt me to write you relative thereto.

I have seen a number of first-class buildings in which Portland cement trimmings were used, having been made both by the poured and tamped methods, and what seemed to be shrinkage cracks were plentifully distributed on their surfaces, especially on projections, such as water tables, window sills, etc., where the weather apparently came in contact with the work more than elsewhere. Close to these very buildings may be seen sidewalks made of Portland cement concrete, upon which there is much fatigue, exposed to weather, during the last winter covered with ice and snow most of the time, yet there are no such cracks to be found.

This fact led the writer to examine many concrete sidewalks, many of which had no great pretentions to being first-class work, but the shrinkage cracks were not to be found. The buildings referred to being of high grade there is no doubt but what good material, skill and care were used in the execution of the work, all things considered more than would ordinarily be used in the making of a sidewalk, yet where cracks were studiously avoided they are to be found in plenty, and where they would do little harm they are practically absent. This is a puzzle to many cement workers. An understanding of the difficulty would be a great benefit to the cement business Can you give us a solution of the difficulty?

EDWARD LAWLOR,
Cleveland, O.

This letter is referred to our readers with the hope that it will give rise to some discussion of the reasons for the cracks referred to and of methods which can be used for preventing the trouble. The cracks referred to in the letter may fairly be assumed under its phraseology to be surface cracks.

These hair cracks frequently appear in new cement walks which have been troweled too much in finishing or have otherwise had a thin coating of practically neat cement form on the surface. A walk which is much used soon loses this thin skin, which does not resist the wear of traffic so well as the mortar or concrete immediately underneath, and the cracks disappear with the coat in which they appear. Possibly the poured blocks have a similar tendency under some conditions toward a thin coating of neat cement on the surface and there is not the same wear of traffic to remove the objectionable appearance. One of the latest patents on poured stone blocks seems to have been developed with the intention of removing all possibility of this objectionable appearance. The block is not affected by the cracking, which is confined strictly to the surface, so that it is only the appearance which is affected and not the strength of the block.

The writer has not happened to see any tamped blocks, which were well made, in which surface cracks developed. There is a tendency to reduce the amount of cement used in making blocks below that necessary to fill the voids in the aggregate used, due attention not being paid to the great differences in proportions of voids in sand and gravel mixtures having similar appearance on superficial examination. Thus blocks made with the same proportion of cement and aggregate will be dense or porous according to the proportions of voids and their condition in this respect be unknown to their makers. Frequently, also, the blocks are allowed to set without supplying water enough to offset evaporation, so that the concrete on the outside of the block does not reach its full strength and hardness. As a consequence the surfaces of such blocks, whether dense or porous, will be acted upon by the weather when a well made block would be permanent. The action of the weather is intensified if the block is porous. The surface appearance of these badly weathered blocks would scarcely be similar to that of the poured blocks referred to, but would be equally objectionable. The letter does not state the differences in appearance.

Will our readers report the results of their observations in full detail, especially regarding the points above mentioned, and from their combined experience a theory may be formed and a remedy suggested.

PATENTS ON HOLLOW CONCRETE BUILDING BLOCK MACHINES.

Can you inform me through the question department what machines for concrete blocks do not infringe on the patent rights of Harmon S. Palmer?

J. M., Long Island City, N. Y.

This is a question which has not yet been judicially decided. It is understood that suits have been begun against the makers of two or three machines for in-

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fringement of the H. S. Palmer patents, but these suits have not yet been carried to the point of decision in any court, so far as our information extends. Many names of manufacturers of concrete block machines will be found in the "Business Directory" under the headings "Cement Construction" and "Concrete Blocks." Doubtless all of these firms will give bonds protecting purchasers of their machines from damages for infringement of patents of others, and this is the best that can be done until the suits referred to are decided.

The subject of patents on hollow concrete building blocks is considered in this department in vol. xxiv, p. 436, where references are made to patents issued prior to 1889, when one of H. S. Palmer's patents was issued. Descriptions of the various machines and processes are given in Municipal Engineering, nearly every number for the past two years, making some addition to the record. The numbers and dates of patents on machines and processes issued during this period will be found in the lists of "Recent Inventions," appearing at frequent intervals in the department of "Machinery and Trade."

Purchasers of machines must, at the present time, make their own decisions regarding the independence of patents on machines and upon the form and sufficiency of bonds guaranteeing protection from suits for infringements.

SIEVES FOR TESTING CEMENT.

Will you kindly inform me where I can procure standard sieves for testing cement for fineness?

W. F. S., Maquoketa, Ia.

Reference to the Directory of American Cement Industries' list of machinery and supplies for cement plants may be made for a list of manufacturers and dealers in testing machines, from whom the standard sieves for testing cement can be obtained. It includes Fairbanks, Morse & Co. of Chicago, Falkenau-Sinclair Machine Co., 113 N. Twenty-second-st., Philadelphia, Pa.; T. Olsen & Co., 500 N. Twelfth-st., Philadelphia, Pa.; Riehle New York City, was inadvertently omitted. We are informed that there are designs of this machinery which are suitable for grinding slag cement as well as the raw materials of which it is composed.

CAUSE OF CHECKING AND EFFLORESCENCE ON CEMENT SIDEWALKS.

Can you give us a reason for sidewalks checking and the Portland cement rising to the surface in such a manner that it can be picked up in the hands? Our opinion is that the fault is in the cement itself, and ask you to kindly let us know what you think about it.

SCHILLINGER BROS. COMPANY,
Detroit, Mich.

The effervescence noted is due to the washing out of soluble salts in the cement or in the sand, the evaporation of the water leaving the deposit on the surface which can be brushed off. This is discussed in an answer to a question in vol. xxiv., p. 435. It does not ordinarily result in cracks or checking, and is often no injury to the work and soon passes away. Cement which is impure enough to disintegrate the walk would show its condition in tests with sufficient distinctness to be rejected. The sand and gravel or broken stone should have careful examination for similar impurities.

The most common cause for checking and rubbing off is the defective manner of laying, and especially finishing the walk. If the surface coat is laid too wet, or is troweled too much, so that the cement is brought to the surface, it forms a thin skim on the walk which will soon check, and may even be rubbed off. The latter occurs especially if the heat is such that the walk dries out too quickly and sufficient water is not retained for the process of crystallization. Some sidewalk makers try to correct the fault mentioned by sprinkling dry sand mixed with cement, or cement alone on the surface during the process of finishing. Those who are experts seem to be able to do it without objectionable results, but very frequently this exaggerates the fault.

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supply of water to the cement during the process of its setting.

There has been some discussion of both these questions in this department during the past two or three years, and additional communications from practical observers will be welcome.

COST OF SLAG CEMENT—SLAG PAVING BLOCKS.

We notice in your question department in the April number of your magazine, an inquiry about the cost of slag cement. The following figures regarding this may be relied upon as absolutely accurate. They represent the writer's experience as Treasurer and General Manager of the Maryland Cement Company of Baltimore. We will be very glad to give your correspondent any further information he might desire.

—SLAG CEMENT.—

Cost for an output of 5,000 bbls. per month.

Mill force, labor & superintendence, per bbl	$0.160
125 tons coal at $3.05 per ton	0.076
Lime. 3,000 bushels at 16c per bu	0.100
Slag, 900 tons at 50c per ton	0.090
Repairs per month $100	0.020
Oil, grease per month $40	0.007
Contingencies	0.011
Totals	$0.464
Administration per bbl	0.121
Totals	$0.585

We notice also in the same department an inquiry in regard to slag paving blocks. As you say, the only ones made were furnished by the Vulcanite Paving Company of Philadelphia, and the writer had a conversation with the late Dr. Filbert on that subject some three years ago before leaving Baltimore, as the question arose of building a plant at Sparrows Point. We think, however, that the Sparrows Point slag is too soft for that purpose, and the price was also rather high. The old process slag from the dumps in this region would be better adapted. The proposition was a good commercial proposition, though the article has never been placed on the market or pushed to the extent that it should have been.

BOILLEAU & LYON,
Easton, Pa.

WHAT BRAND OF CEMENT WAS IT?

Sixteen years ago in an order of five barrels of Portland cement purchased at Fergus Falls, Minn., were two barrels of a bright yellow cement, no brand on barrel. The user claims these to have been the most excellent cement he ever used, very quick setting and remarkably hard. He asks me if I can identify the brand, which I cannot. Can you?

W. C. T., Thief River Falls, Minn.

Perhaps some of our readers in the Northwest will recognize the brand. Was it made from materials such as the Western Portland Cement Company used later at Yankton? That company was established in 1890, later than the date mentioned.

CONCRETE WALK WITH TWO KINDS OF CEMENT.

In your number for April, 1904, under the head of "Concrete Walk with Natural Cement in Base and Portland Cement in Top," I note a surprising statement signed by a correspondent that "Natural cements are but a high grade of lime which require to be exposed to the atmosphere before setting can take place."

As a manufacturer of natural cement for over thirty years, I am astonished to see information of this character printed in a paper of the scientific reputation of your own. It is a well known fact that natural cement will set under water, and set by the formation of hydro-silicates and aluminates of lime; that natural cement is essentially a material which sets from the inside to the surface, and is not like lime which sets by the formation of carbonates of lime, produced by the taking up from the air at the surface of carbonic acid gas.

The work that has been done with natural cements in this country within the past sixty years, is ample evidence of the error in the statements shown in the letter of your correspondent, and it is needless at this time, to enter into a defense of cements that have done such good work as those of the Rosendale, Cumberland, Louisville, Milwaukee, Lehigh, Akron and other well known cement districts.

So far as the statement made of the great difference between the specific gravity of Portland cement and natural cement, it may be interesting to know that there are natural cements in this country which have a specific gravity up to 3.00 and closely approaching that of Portland cement. These natural cements show under every condition, except that of the seven days' and twenty-eight days' tensile strains in sand mortars, results approaching very nearly those of Portland cement, whereas at longer periods up to five and ten years, their records show a continually growing curve as contra-distinguished from the fluctuating growth of the Portland cements.

While the writer does not believe in the making of sidewalks of two grades of cement having different conditions so far as contraction and expansion are concerned, he does not feel that a statement such as you publish as to the character of the well-known products of this coun-

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try should go unchallenged. In defending them he does it possibly with considerable better grace than the manufacturer of natural cement alone would be able to do, inasmuch as his business career has been identified with the earliest manufacture of Portland cement in this country, under the late David O. Saylor, and subsequently with the American Cement Company, of which he is now president.

R. W. LESLEY,
Philadelphia, Pa.

The communication referred to was inserted in the April number in continuance of the discussion of this interesting subject concerning which information is not widely distributed, with the definite statement that the editor did not agree with the opinion given regarding the chemical action of natural hydraulic cement in setting, and with the hope that full replies would be made by experts who could speak with authority. The result desired has been secured so far as the above letter from one of the oldest manufacturers and experts is concerned, and it is to be hoped that others will express their opinions if they differ in any respect from Mr. Lesley's. The use of two kinds of Portland cement is another phase of the same question which is considered in the following letter from another correspondent, W. F. Mann, City Engineer of Kokomo, Ind.:

In your last issue of Municipal Engineering the important question of the advisability of using a Portland cement in connection with a natural current was discussed. The conclusion that the two will not unite and form a perfect union is certainly true. The one setting in a few hours, the other in a few minutes would give a mechanical union similar to and not much more perfect than that between two bricks, while the chemical union is largely destroyed by the excessive lime contained in the natural cement. This discussion leads up to one of equal importance, to-wit: Whether it is good practice to use two kinds of cement (Portland) in the construction of sidewalks and cement curbs and gutters? The old forms of specifications required the core of the work to be made with American Portland and then one-inch facing to be put on with a German cement. This springs the question as to a perfect union forming between the two makes of cement. Many contractors and cement workers insist that a better job can be made of a good American cement [illegible] however tions should be used in sidewalk and gutter work. The best and latest practice, no doubt, is the use of one cement alone and this, of course, in curb and gutter work should be the best attainable if permanent and lasting qualities are to be expected.

Our correspondent is correct in stating that the best American Portland cements are fully equal to the foreign cements and most of the larger cities have removed from their specifications the restriction for walk or for top surface to German or other foreign Portlands. The use of cheaper grades of Portlands in base and of the best grades in top is similar in principle to that of natural cement in base and Portland in top. Many of the cheaper Portlands are really natural cements from specially selected rock; are adulterated with natural cement; are made from the less thoroughly burned clinker from the older forms of kiln; or are made from materials or by methods which do not produce the proper chemical combinations. Their use in conjunction with better cements in walks is therefore only less objectionable than that of natural cements because the differences are ordinarily somewhat less and the chances of trouble are therefore somewhat reduced. There is no longer any necessity for restricting contractors to foreign cements in any part of a cement walk and there is every reason (except that of reducing first cost a very small percentage) for using the best American or foreign cements throughout the work. Except in times of cement famine the lower cost of the best American cements, together with their superior quality, gives them the inside track.

However, there are so many new brands of cement which are rushed on the market without sufficient test and experiment, that renewed vigilance must be exercised that inferior cements may not be admitted, though properly claiming classification as Portlands.

WHITE PORTLAND CEMENT.

Is there a pure white Portland cement? If so, where can I get it? Is White's Portland cement white in color?

M. H. L., Taylor, Tex.

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cement, but is rather a plaster. There are several cements of this nature and also some puzzolan cements, which are non-staining and approximate more or less closely to whiteness in color, but none of them can be classed as Portland cements and most of them are not suitable for work exposed to the weather. These cements are named in the list of cement brands and in the department devoted to the foreign cement trade in the third edition of "Directory of American Cement Industries" ($5), which is coming from the press as this number of Municipal Engineering is issued.

White's cement is an English Portland cement similar in color to other Portland cements from like materials, both English and American.

PLANS FOR CONCRETE BLOCK HOUSES.

Have you any plans for artifical stone houses? We expect to build quite a number of hollow concrete block houses in our city this year, but as it is a new thing here possibly you could send us some cuts or plans that would be of value to us. We are using the H. S. Palmer machine at present.

M'GEHEE & NORMOYLE.
Roanoke, Va.

As yet there are no plans for houses made with special reference to the use of concrete blocks. Some sample designs of this class of construction are greatly needed. The advertising literature of the various cement block machine makers contain many photographs of buildings which have been constructed, but, as far as the writer has observed, these are not accompanied by plans. It is apparently customary to build without plans or after plans prepared for brick or frame houses. As a consequence the plans often do not fit the material of construction and the architectural effect of which the blocks are capable is not secured. Further consideration is given to this subject elsewhere in this number of Municipal Engineering.

THE EDISON PORTLAND CEMENT COMPANY.

Will you kindly let us know what is the capitalization, preferred and common, of the Edison Portland Cement Company, and whether there is any bonded indebtedness? H. C. B., New York City.

From the third edition of the "Directory of American Cement Industries," ($5), which is issued almost simultaneously with this number of Municipal Engineering, it is learned that the capitalization of the Edison Portland Cement Company is $2,000,000 of 8 per cent cumulative preferred stock, and $9,000,000 of common stock. No bonded indebtedness is reported, and the form of the preferred stock is doubtless intended to obviate the necessity of issuing bonds.

CEMENT FLOOR TILING.

I want the address of a firm or firms making cement floor tiling. I have seen their product but do not know where to locate them.

F. L. SEAGE,
Lansing, Mich.

The American Art Tile Company, Columbus, O., makes cement floor tile. The American Cement Tile Company, 208 Wood-st., Pittsburg, and Wampum, Pa., makes cement roofing tile and may be able to furnish floor tile also.

THE LUMINOMETER.

I should like to know what the instrument called a "luminometer" on page 257 of the April number of Municipal Engineering is and who manufactures it.

H. C. W., Cincinnati, O.

The luminometer referred to is an instrument for measuring the intensity or candle-power of electric light. It is portable and shows with reasonable accuracy the value of the light at any point, and can be used readily to determine the distribution of the light emitted by any lamp. It is made by the General Electric Company. Other photometers of various degrees of accuracy and portability are described in Municipal Engineering, vol. xxiii, p. 106.

MUNICIPAL OWNERSHIP OF GAS WORKS.

Will you kindly let me know of any articles that have appeared in your magazine on the municipal ownership of gas plants and inform me how I may get them? EDWARD S. HAWS,
Fall River, Mass.

There have been numerous articles in Municipal Engineering magazine upon the subject of municipal ownership of public utilities, some of which have made special reference to the public ownership of gas plants. The following are probably the most important of these articles:

The lease of the Philadelphia municipal gas plant to an operating company is discussed in vol. xiii, p. 291.

A Pennsylvania decision in favor of the right of a city to make and sell gas is quoted in vol. xv, p. 175.

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The acetylene gas plant at Wabash, Ind., is described in vol. xvii, p. 380.

Municipal or private ownership and control of public utilities are considered in vol. xiv, p. 1; vol. xvii, p. 195; vol. xx, p. 216, and vol. xxi, p. 16.

"Municipal Light, Heat and Power" is the title of an article in vol. xviii, p. 293, part of which is devoted to gas lighting.

"Cost of Light in Municipal and Private Gas and Electric Plants" is found in vol. xxiii, p. 160.

"Cost and Prices of Gas and Electric Lighting by Municipal Plants" is in vol. xxv, p. 232. These three articles are based on data from reports of the Massachusetts Lighting Commission.

Cost of municipal lighting and municipal ownership are editorially considered in vol. xxiii, p. 168; xxv, pp. 168 and 246.

Some account of the gas plant of Hamilton, O., is given in vol. xx, p. 161, and vol. xxi, p. 105.

A review of the report of the Massachusetts Light Commissioners for 1902 will be found in vol. xxv, p. 47.

Reviews of the reports of the Duluth water and light department, giving some statistics upon municipal operation of gas plants will be found in vol. xxiii, p. 474, and vol. xxvi, p. 200.

All of the numbers in which these articles appear can be supplied at 25 cents each, with the exception of vol. xvii, p. 380, December, 1899.

LOCATION OF SEWAGE DISPOSAL PLANTS.

I wish to know the location of any sewage disposal plants in the vicinity of Louisville, especially those which use the septic tank and filters or contact beds in southern Illinois, Indiana or Ohio, Kentucky or Tennessee.

I. W. S.,
Jackson, La.

The septic tanks at Bedford, Ind., were described in Municipal Engineering in February, 1904, by George C. Houston, City Engineer, who will show the plant to interested visitors. At the Eastern Indiana Hospital for the Insane, near Richmond, Ind., is a plant consisting of septic tanks followed by treatment on gravel beds, which was described in the March number of Municipal Engineering by Prof. R. L. Sackett of Earlham College, Richmond, Ind., who designed and superintended the construction of the plant. Canton, O., is provided with a sewage disposal plant originally designed for chemical precipitation, but now somewhat modified. The Indiana Industrial School at Plainfield has a small septic tank.

Our correspondent's letter indicates that he wishes to see plants installed for institutions, such as the Hospital for the Insane, mentioned, and if our readers can refer him to other plants of that nature their locations will be published.

A TELEMETER.

I enclose a clipping from a paper of recent date with reference to a simple telemeter invented by Lieut. Saporetti of the Italian army.

Please let me know if there is anything in it. If there is, I should like to know its degree of accuracy and where it can be obtained. G. A., San Luis Obispo, Cal.

There are frequent announcements of the invention of instruments for easily measuring distances from the observer. Since the accuracy of the measurement must depend upon the relative length of the known base line to the distance to be measured, and the accuracy of measurement of the angles at the ends of the base, it is evident that no instrument which can be held in the hand at one point of observation only is of great accuracy. Such an instrument is much better than nothing for purposes of getting ranges, etc., but is of value for surveying purposes only in getting rough estimate of distances. The range finders for war ships have a base nearly the length of the vessel, and similar instruments can be devised for use at two ends of measured base lines on shore.

STONE BLOCK PAVING FOR DRIVEWAY.

I have part of a driveway to pave with paving blocks to connect with that already done and I want to know the proper way to begin and complete the same. How deep a bed of sand? How to set the guide stones to keep it oval and accurate, and if it should be left any higher than the old paving?

H. L. M., Pawling, N. Y.

The ground under the proposed pavement should be excavated carefully and then rolled or tamped to make it as solid as possible, the finished surface being parallel to the proposed top surface of the pavement. Any soft spots should be taken out and filled with good dry earth and again tamped or rolled. If the driveway has curbs, a wooden form can be made of the right shape for the crowning of the roadway and the surface can be made to fit this form as it is drawn along the curbs. The excavation should be the thickness of the paving blocks and six inches more below the proposed surface of the pavement, the

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six inches to be filled with loamy sand or a mixture of sand and gravel. The top surface of this sand can be shaped by using the form described, proper change being made at the curb for the six inches of sand put in. On this sand the blocks are laid and thoroughly tamped to place. If this tamping is well done and the sand surface is well formed, the new pavement will not settle below the old. The shape of the stone pavement surface can be tested with the same form, but not so accurately as the other surfaces. The eye can correct almost any probable variations. If there is no curb, a temporary curb made with stakes and planks spiked to them can be improvised.

SPECIAL CHEMICAL TREATMENT OF CONCRETE.

I have been a reader of your magazine for about a year, and have followed with a great deal of interest the development in cement and concrete construction. Last October this little city was visited by a fire that destroyed the business portion of the town. Under building ordinances passed at once all new work must be of brick, stone or concrete. The people of this community, knowing very little as yet about concrete for building purposes, have been slow to take to it. There is presented a wonderful discovery, known only to one person, a profound secret in chemistry, that makes the concrete not only very much better in every way, but makes it absolutely water-proof. The samples shown are water-proof all right, but in looking around in different places I have discovered other men who tell similar stories of being the only living possessors of a chemical that produces wonderful transformation in concrete, making it water-proof, etc., etc. However, I was shown a chimney in a house in Everett made by this wonderful process, and was surprised to find it soaked through in spots below the ceiling. A concrete man who does a large amount of work for the United States, as well as for railroad companies, tells me that it is true that the acid used makes a concrete that sets up very quickly, but it very quickly sets up a destructive action, especially in this moist climate, and the stuff becomes porous and crumbly. What I am after is facts, and it is rather difficult to determine at this place, quickly, what are the facts concerning the effect of this kind of building material. So you will confer a favor on myself and a number of others who are now in a quandary what to do. I should have stated that we have no building stone nor clay that will make brick; therefore, building of brick or stone that has to be brought in by water or rail makes our work very expensive.

Query: First, what acid is used in concrete work? Second, what effect does it have on the work; is it beneficial or otherwise? Third, would you advise the use of it? G. A. W.

Aberdeen, Wash.

It is well to look with suspicion upon any secret process of improving concrete by the use of chemicals. Either the process is an old one, or it is untried, or has been tried and found wanting. There may be some valuable discovery which has not yet been made, but when it is made it can be patented, and it can stand on its merits. In nearly every recent number of this magazine there has been some information about the use of various chemicals in hastening the hardening of cement and on making concrete water-proof. One claim for the hollow concrete blocks is that they make dry walls so that the moisture will not get through to the inside. No special treatment beyond good proportions of materials and good workmanship is really necessary to make good building materials out of cement.

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MUNICIPAL MATTERS IN COURT

Higher Courts—Gas Price in Chicago—Connecticut Municipal Ownership—Leavenworth Water Works Bonds—New Albany Water Company Consolidation—Denver Electric Company Consolidation—Massachusetts Water Works Purchase Cases—Corrupt Attorneys Opinion—Damages From Water Company for Fire Loss—Cincinnati Water Contract in Court.

Abstracts of Decisions of the Higher Courts in Matters Relating to Municipalities.

Prepared by Russell T. Byers, LL. B., Indianapolis, Ind.

1. Assessment Roll—Sufficiency—An assessment roll is held sufficient though it did not state width of intersections, length of pavement, or indicate how the amount of the assessment was to be determined, or refer to the contract under which work was done. Walker vs. City of Detroit et al. 98 N. W. Rep. (Mich.) 744.

Assessment—Part Payment Estopped Objection Later—The law of 1897, providing that the payment of one installment of an assessment is a waiver of the right to object to the payment of subsequent installments is held to be operative. McDonald et al. vs. People Eshel Hamberg, etc., 69 N. E. Rep. (Ill.) 509.

Highways, Widening not Opening—A law requiring that a road or street in a village may be widened or altered only by consent of three-fourths of the owners in interest of the land fronting on that part of the street which is affected, may not be avoided by filing a petition to lay out a public street. A petition to open a street does not confer jurisdiction to widen an old one. A variation of 300 feet in the beginning point of such street is such a material alteration as to cause the proceedings to be set aside. Norton vs. Truitt et al., 57 Atl. Rep. (New Jersey) 471.

Assessment—Sufficiency—Where only a portion of one's property is taken it is proper to determine the benefits of that part remaining in determining the amount of damage, Pittsburg Railway Company vs. Town of Wolcott, 69 N. E. Rep. (Ind.) 451.

Railroad Crossing, Planking Between Tracks—When a street has been opened over railroad tracks a plank crossing must be maintained over them by the railroad company. This expense is an element of damage proper to be assessed in the proceedings to open the street. Baltimore & Ohio Co. vs. Mayor, etc., of City of Baltimore, 56 Atl. Rep. (Md.) 790.

Sewer Construction; Variation from Specifications—The contract for the construction of the sewerage system provided that the city might depart to some extent from the plans and specifications, and that in any matter of dispute arising under the contract as to materials furnished, etc., the decision of the City Engineer should be final is upheld. City of Mobile vs. Shea, 127 Fed. Rep. 521.

Special Assessment—Notice of Hearing—The statute provides that where public improvements are to be paid for in part by assessing abutting property-owners, a two weeks' notice of the time that the Council will meet to consider such improvements must be give by publication. A publication once a week for two weeks is not sufficient unless the first publica-

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of the Council. Auditor-General vs. Calkins et al. 98 N. W. Rep. (Mich.) 742.

Streets — Remonstrances — Front Foot Rule—Notice provided for in Sec. 4288, Burns' R. S., 1901, held sufficient. A remonstrance to be effective must be filed during the time that the notice runs. The fact that the work is to be assessed by the front foot and without regard to the benefits is not objectionable, when taken in connection with the ordinance authorizing the improvement. McKee vs. Town of Pendleton, 69 N. E. Rep. (Ind.) 997.

Streets and Sidewalks — Contracts — The city of St. Louis made annual contracts for the construction of sidewalks. The ordinance under which the present street improvement was constructed did not refer to the sidewalk improvement at all, except to provide how it should be paid for. Held, that this was not such a disregard of the St. Louis city charter, as would invalidate the tax bill for the street assessment. Nor is it a defense to the tax bill for such street improvements that it was levied before the sidewalks, to be constructed by another contractor, had been completed. Heman Const. Co. vs. Leroy, 78 S. W. Rep. (Mo. Sup.), 614.

Street Improvements—Assessment, Ten-Year Plan—Under act April 19, 1890, providing for street improvements, where no request was made by property owners for the adoption of the "ten-year plan" for paying for the same, the statute of limitations would run in five years from the time of the completion of the work. The statute applies to collection by distraint as well as to suit to enforce the lien. City of Lexington et al. vs. Crossthwaite, 78 S. W. Rep. (Ky)., 1130.

Street Improvements, Designation of Material—Details—Where there was but one kind of coal-tar cement made that could be used, an ordinance providing for the use of such cement is not void because it prevents competition and denies the taxpayers the right to have the work done by the lowest bidder. It is not necessary in the specifications to use the word cement, where it is otherwise sufficiently referred to. An ordinance need not provide for every detail of the work, when such details are left to the discretion of certain city officials. Swift vs. City of St. Louis, 79 S. W. Rep. (Mo.), 172.

Street Paving, Defects in Procedure—In proceedings brought to confirm an assessment after a prior confirmation has been reversed, the county court has power to eliminate that portion of the property-owner's assessment which is wrongful and then confirm the judgment. When the engineer's estimate is not made a part of the original resolution, the objection may not be raised for the first time when an application has been made for a judgment of sale. An alien labor clause in the specifications does not invalidate an assessment where the record shows that the bids were not made upon that basis. Thompson vs. People ex rel. Hauberg, etc., 69 N. E. Rep. (Ill.), 842.

Water Supply — Monopoly—City Liable for Water when Furnished—Where a city makes a contract with a water company to supply water, but the contract is void because it creates a monopoly the city is liable for water furnished. A contract to supply water for a number of years does not of itself create a debt. It is only as the water is used by the city that the obligation ripens into an indebtedness. City of Tyler vs. L. L. Jester & Co., 78 S. W. Rep. (Tex.), 1058.

Water Works — Debt Limit — Bonds—A suit brought by a taxpayer to enjoin the city from issuing municipal bonds to pay for a system of water works will be sustained when such issue of bonds in addition to the then indebtedness of the city exceeds 10 per cent of the total taxable property valuation of the city. The right of the city to exceed this limit cannot be conferred by a two-thirds vote of the electors. Purcell vs. City of East Grand Forks et al., 98 N. W. Rep. (Minn.), 351.

Final Decision on 75-Cent Gas in Chicago.

The United States Supreme Court handed down a decision April 4, sustaining Judge Grosscup of the Federal Court in an opinion handed down more than three years ago, when the People's Gas-Light & Coke Company sought to restrain the city of Chicago from enforcing an ordinance passed in Oct., 1900, providing for 75-cent gas. The company claimed a contract right to charge $1 per thousand feet for gas. The question of the city's power to regulate the price of gas is not passed on, as the Federal Court declared it lacked jurisdiction as soon as it found in force no contract between the State and the company for gas at $1. Several points were considered, including the provisions of the act of 1897, which made possible the consolidation of ten gas companies in Chicago in that year, the consequent fixing of the price of gas at $1 a thousand feet in conformity with the provisions of the statute, and the conditions imposed in previous enact-

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ments by which the gas companies had been charging as high as $3 per thousand feet for gas. The People's company had claimed various immunities which the court denied.

Abstracts of the opinion read by Chief Justice Fuller are as follows:

The Circuit Court held that the contention that the State's power to regulate rates had not been delegated to the city, was not a federal question, and that as the ground of impairment or deprivation of contract rights acquired by the charter failed under the bill framed by the attorneys for the gas company, the court could not go farther and decide that question in this case.

The decree, as its stands, in fact reserved the question to be raised in some other appropriate suit in the proper court. In these circumstances we are constrained to decline the consideration of that question so far as it relates to the contention that the power to regulate was conferred by the general law of Illinois of 1871-72, providing for the incorporation of cities and villages under which the city of Chicago, as now constituted, was incorporated.

Concerning the effects of the general provision of 1897, whereby the gas trust was created, the court says:

We agree with the Circuit Court that the clause of section 11 of the act of 1897, that such corporation shall not increase the price charged for gas during any part of the year immediately preceding such purchase or lease, read according to the plain and ordinary significance of the words, was not intended to fix and did not fix a rate unalterable by either party, but simply a rate above which consolidated companies could not go.

After discussing the various enactments cited by the company's attorneys as preventing the city from regulating the price of gas the Supreme Court said:

That is to say, was the city cut off from reducing the price below $1; had the city power to do so? It is contended that the first part of the amended charter of 1865 granted the city a general power to regulate the price after ten years, and that the latter part (referring to the rate of $3 per thousand feet for gas) then ceases to operate as a restriction, on the other hand, that the whole clause constituted a contract that the general assembly would not thereafter authorize the city to fix a rate at less than $3. But it is expressly conceded that the general assembly possessed the power to regulate the price of gas and prescribe reasonable rates and that as complainant availed itself of the act of 1897, and thereby acquired the plants of other gas companies, it can now only charge the rate it had been charging the year immediately preceding the acquisition of these properties, namely, $1 per thousand cubic feet.

Assuming, without intimating any opinion to that effect, that by the amended charter of 1863 the city contracted with the People's Gas Light and Coke Company that the city should not thereafter be empowered to reduce the price of gas below $3 per thousand feet, the preliminary inquiry is whether by the consolidation that contract was extended to the plants of and territory occupied by the companies absorbed. The Circuit Court holds that it was not so extended, and that as the bill sought relief in respect to the entire plant and territory, the entire system, as consolidated, it could not be maintained, because there was no such contract which the ordinance impaired or destroyed.

The Supreme Court held that no matter what exemption the operating, or parent, company may have primarily held, an exemption from regulation of gas rates by the city, held by this company, would not pass to other constituent companies unless it was specifically provided for in the creating act. The court adds:

So that the act of 1897 cannot be construed as extending any prior immunity the acquiring company possesses over the whole system of all the consolidated companies, and if not, and the Circuit Court was right, as we think it was, in holding that under the present bill complainant's alleged exemption could not be enforced as to so much of the system as originally belonged to it, then the court was justified in declining to discuss whether by the consolidation the alleged exemption was lost altogether.

Bond Ordinance for Purchasing Leavenworth Water Works Declared Invalid.

The Supreme Court of Kansas held, April 9, that the $400,000 water-works bonds voted by the city of Leavenworth are invalid for the reason that the ballots which were voted at the election declared that the bonds to be voted were for the purchase of the water-works plant or for the construction of a new plant; that the purchase of the water-works plant could not be accomplished in the manner attempted by the city administration. Under the terms of the franchise of the water-works company, granted twenty years ago, the city was to be allowed to purchase the plant when the franchise expired. It was provided that three appraisers of the property should be selected—one to be selected by the company, one by the city, and the third by these two. By the enactment of an ordinance changing the method of

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selecting the board, the water company was beaten out of its member of the board of appraisers. The court holds that this ordinance is invalid.

Municipal Ownership of Lighting Plants Is Constitutional in Connecticut.

The Supreme Court of Connecticut has rendered an opinion upholding the constitutionality of the law providing for municipal ownership of lighting plants where the citizens vote to purchase an existing private corporation. The court decided, at the same time, that the city of Norwich must buy the Norwich Gas & Electric Company at a cost of $590,000, plus the value of supplies on hand, this figure having been made by a committee on appraisal, or must pay the company $190,000 and leave the property in the hands of the bondholders. The amount of the bonds of the company is $400,000 secured by a mortgage, and the value of the supplies on hand is about $20,000.

New Albany Water Works Consolidation.

The litigation between the majority and minority stockholders of the New Albany Water Company, which has been in the United States Court for two years, was terminated March 29 by the purchase of the minority stock by the holders of the majority stock for a consideration of $108,900, the par value of the stock, one-half of which is to be paid in cash and the other half in six months, the deferred payment to bear 5 per cent interest. Under the new plan the Indiana Water Company and the New Albany Water Company will be consolidated under the new agreement.

Merger of Denver Electric Companies Contested.

Suit was instituted in the United States Circuit Court April 5 by Morgan Jones of Denver, Colo., to set aside the $20,000,000 consolidation of the Missouri Electric Light and Power Company, the Union Electric Light and Power Company and the Citizens' Electric Light and Power Company, now constituent corporations of the North American Electric Company of Philadelphia, alleging that the merger was effected by fraud. Mr. Jones avers that he is the owner of more than $100,000 worth of stock and that other stockholders stand ready to join him in the proceedings. He asks the court to declare the merger illegal; that an injunction be forthwith issued to restrain the officers of the consolidated companies from a further use of funds; the appointment of a receiver to take charge of the Missouri Edison Company's property and franchise pending the settlement of the litigation.

Newburyport and Gloucester Water Works Purchase Cases Dismissed by U. S. Court.

The United States Supreme Court rendered a decision April 4 in favor of the cities in the cases of the Newburyport Water Company vs. the city of Newburyport and the Gloucester Water Supply Company vs. the city of Gloucester. The companies endeavored, by a bill in equity in the Circuit Court, to avoid the sale of their water works to the cities and to set aside the proceedings of the Massachusetts Supreme Court to ascertain the purchase price, on the ground that these proceedings amounted to a taking of the companies' property without just compensation, in violation of the 14th amendment to the constitution. The bill was dismissed by the Circuit Court and an appeal taken to the United States Supreme Court. The decision rendered April 4 remands the cases to the Circuit Court with directions to dismiss them for want of jurisdiction. In handing down the decision Justice White declared that the federal question on which the case was appealed is so attenuated and unsubstantial as to be absolutely devoid of merit.

Water Consumer Awarded Damages from Water Company for Fire Loss.

A jury verdict has been rendered in the case of the Allen & Curry Manufacturing Company against the Shreveport Water Works Company, at Shreveport, La., awarding damages to the plaintiff in the sum of $35,649.30. The amount originally sued for was $47,649.30, and of this $10,000 was for loss of time and $2,000 for loss of profits on contracts which were being filled. These items were afterward practically abandoned by the attorneys for the plaintiff. The suit grew out of the destruction by fire of the plant of the Allen & Curry Manufacturing Company. The evidence submitted showed that when the fire department responded to the fire alarm it found that the hydrant on

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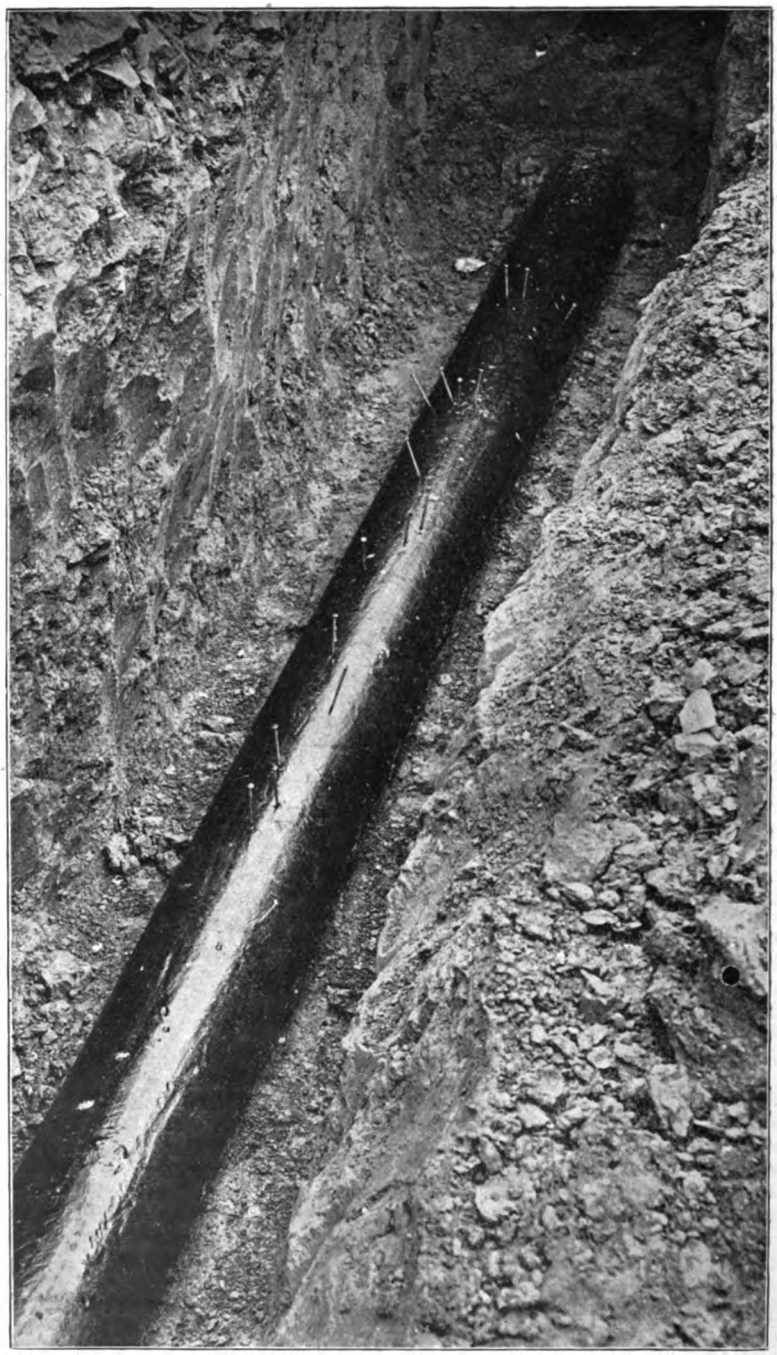

FIG. 1—SIX-INCH MAIN AT GEYER AND EIGHTEENTH STREET. (SERIOUSLY CORRODED.)

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Texas-ave. near the plant was not in working order and that no water would issue from it.

City Attorney Liable for Opinion Corruptly Influenced.

The Michigan Supreme Court handed down an opinion April 6, affirming the conviction in the Circuit Court of Thomas F. McGarry, an attorney of Grand Rapids, on the charge of bribery in the Lake Michigah water deal, at Grand Rapids. Among the contentions in McGarry's appeal was one that he was charged with bribing City Attorney Lant K. Salsbury, an official without authority in the council, which would have to grant the water franchise. In answer to this the Supreme Court cited the statute making it a punishable offense for the city adviser to give an opinion corruptly.

A Cincinnati Water Works Contract in Court.

Suit has been filed at Cincinnati by the United States Construction Company to enjoin cancellation of its contract to construct the settling reservoirs of the new water-works plant. The water-works commissioners, collectively and individually, and the city are defendants. The plaintiff company alleges that it was misled as to the character of the materials it was bound to encounter, and also claims to have done a large amount of work in excess of its contract requirements on account of these undiscovered and concealed facts, for which it asked for payment, but was refused. The company also claims that while it has endeavored to make good its contract, the city, on the contrary, has failed to make its side good; that the defendants are about to transfer their contract to another company and to keep the plaintiff from the enjoyment of the compensation and profits due for past work, and which, in the nature of events, would be increased if it were permitted to continue the work on an equitable and just basis; the plaintiff was unable to know the presence of an immense amount of "conglomerate" which it later encountered in its work, not only because of the failure of the city and its engineer to make its presence known, but also because rains had washed the previous excavation of the first contractor. The plaintiff asks for an injunction and for such relief as the court may find due it.

WATER WORKS

Electrolysis—Thawing Pipes by Electricity—Quincy Filters—Tullahoma Water Plant—Raising Water by Compressed Air.

Some Examples of Electrolysis of Pipes.

The accompanying photographs show the effects of electrolysis upon water and gas pipes. They were obtained during an electrolytic survey of the city of St. Louis, Mo., by and under the direction of Mr. E. E. Brownell of Dayton, O., to whom we are indebted for them. This survey was undertaken for the water commissioner of St. Louis to determine the deterioration in water pipes which is proceeding under the existing conditions.

Fig. 1 shows a six-inch water main, so soft that it could be easily cut with a penknife, and the eight-penny nails shown were driven half through its shell. The tar coating is entirely destroyed and there were many deep pits in the surface, in some cases extending more than half through the shell. The soil was natural sandy clay. The pipe was carrying four amperes of current and showed no evidence of electrolysis by current jumping the pipe joints.

Fig. 2 shows a thirty-inch main into which sixteen forty-penny spikes have been driven with ease. The first spike to the left is driven in a pit, the actual size of which is shown in the accompanying small cut. The two pits seen in Fig. 2 are each from ½ to ⅝ inch deep. The pipe had been in the ground but sixty months. It carried sixty amperes and

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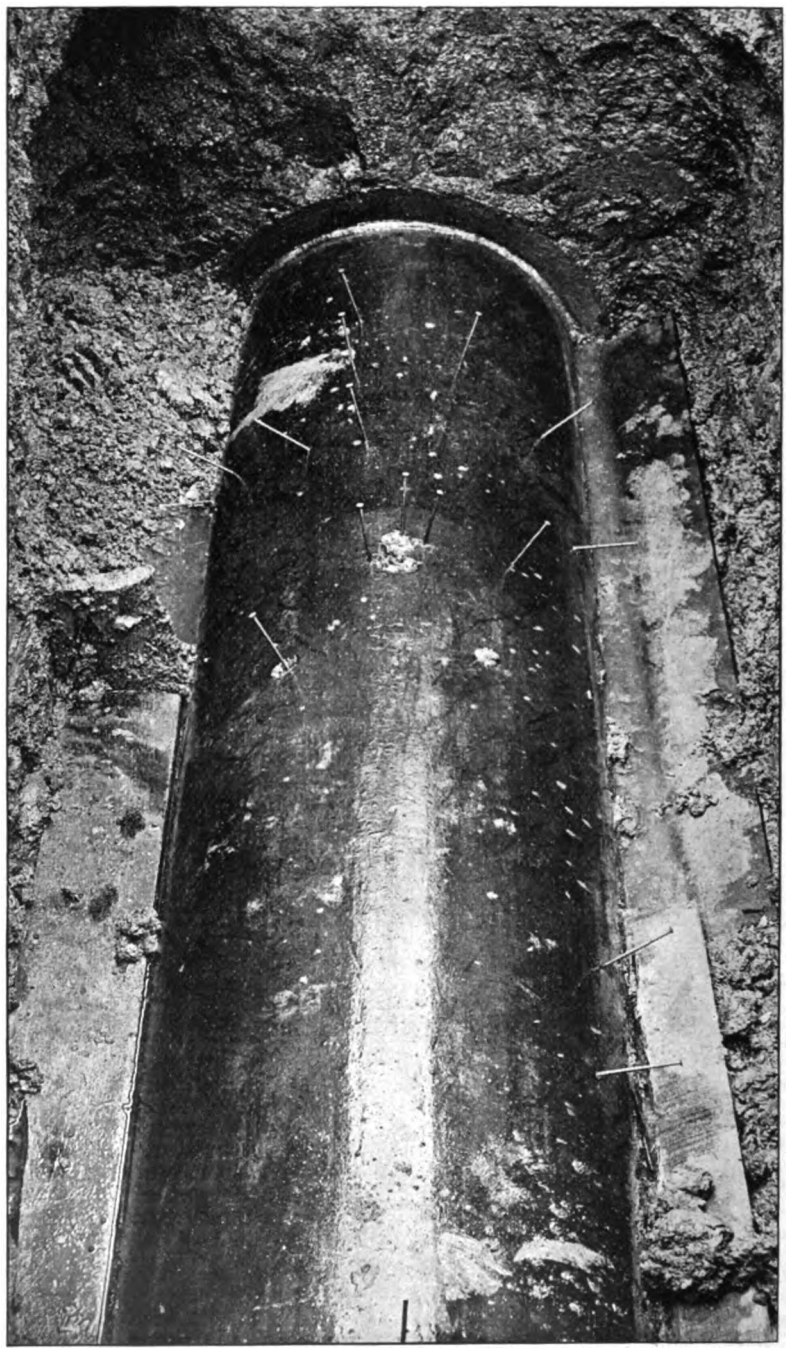

FIG. 2—A THIRTY-INCH MAIN AT CHOUTEAU AND COMPTON AVENUES.
(CRITICAL; LAID MARCH, 1897.)

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showed no electrolysis due to shunted currents about the joints, but the lead calking was slightly deteriorated. The soil was natural, heavy, wet, blue clay.

A TUBERCLE FROM THE THIRTY-INCH WATER MAIN AT THE CORNER OF CHOUTEAU AND COMPTON AVENUES. FIG. 2. (ACTUAL SIZE.)

Fig. 3 shows a thirty-six-inch main down seventy-two months. There are many pits ⅝-inch deep and forty-penny spikes were easily driven half through the shell. The soil is mixed clay and loam filled with water, very favorable conditions to electrolytic action.

Fig. 4 shows a 48-inch main generally corroded but nowhere more than ⅛ inch deep. This pipe was only two volts positive to the rails and the electrolytic action is correspondingly slow.

Fig. 5 shows a six-inch main subjected to electrolytic action but little more than a year. The pits cover almost the entire surface and are about 1-16 inch deep. The soil is of clay origin, favorable to the preservation of sub-surface metallic structures not subjected to electrolytic action

The "drainage system" of getting rid of the electric currents without the electrolytic action due to the current leaving the pipe to jump to another conductor has been used in some districts. This improves the condition of the pipes near the points where the drainage connections are made at the expense of pipes in other neighborhoods and of pipes in other systems.

Fig. 6 shows a gas main in St. Louis to which the drainage system has always been applied at a point 1,980 feet distant. Its complete destruction has taken place notwithstanding the attempted protection.

Figs. 7 to 10 show other gas mains whose usefulness has been entirely destroyed by electrolytic action.

The summary of the results of the St. Louis survey of the water pipe system alone shows 120.87 miles of water mains where the current is leaving the rails and going to the pipes, forming the negative district in which the electrolytic action is on the rails and there is no deterioration of the water pipes. There are 53.9 miles of water pipe in the positive district which is the danger district, the electrolytic action of the current in leaving the pipe causing the deterioration so graphically shown in the photographs. The total amount of current passing back to the rails to, from and over the water pipes is 6,149 amperes.

A detailed statement of the amount of annual loss of iron from the pipes in each street in the positive district due to the electrolytic action foots up 122,980 pounds of metal extracted from the water pipes each year. This loss will ultimately demand the renewal of all these miles of pipe. Those in which the action is rapid must be soon renewed, and those in more favorable districts later. The cost of replacing all the pipes now affected, not including service connections and pavements, is $1,119,360. This takes no account of the gas pipes and the service connections for water and gas, which are also subject to similar deteriorations.

The average electrical resistance of the intervening earth between the tracks and water pipes is 0.051 ohms, and ranges from 0.106 to 0.032. The highest average resistance reported by Mr. Brownell is at Lockport, N. Y., 0.0846 ohm, and the lowest in the borough of the Bronx, New York City, 0.0392 ohms.

The method of making an electrolytic survey as stated by Mr. Brownell will be of interest. It is as follows:

The most accurate results can be obtained, in making an electrolytic survey, with the following methods and electrical apparatus:

The first thing necessary is to record the difference of electrical pressure between the pipes and the rails, giving the character of the electrical polarity. In this survey there was used a selection of twelve different scale-reading voltmeters, readable from .00001 to 150 volts, all of which were of Weston manufacture, with guarantees of great delicacy and accuracy.

By interposing into the circuit which gave the difference of potential reading, a Chauvin & Arnoux micro-ohmmeter, with calibrated leads leading from the pipes to the rails, I thereby recorded the

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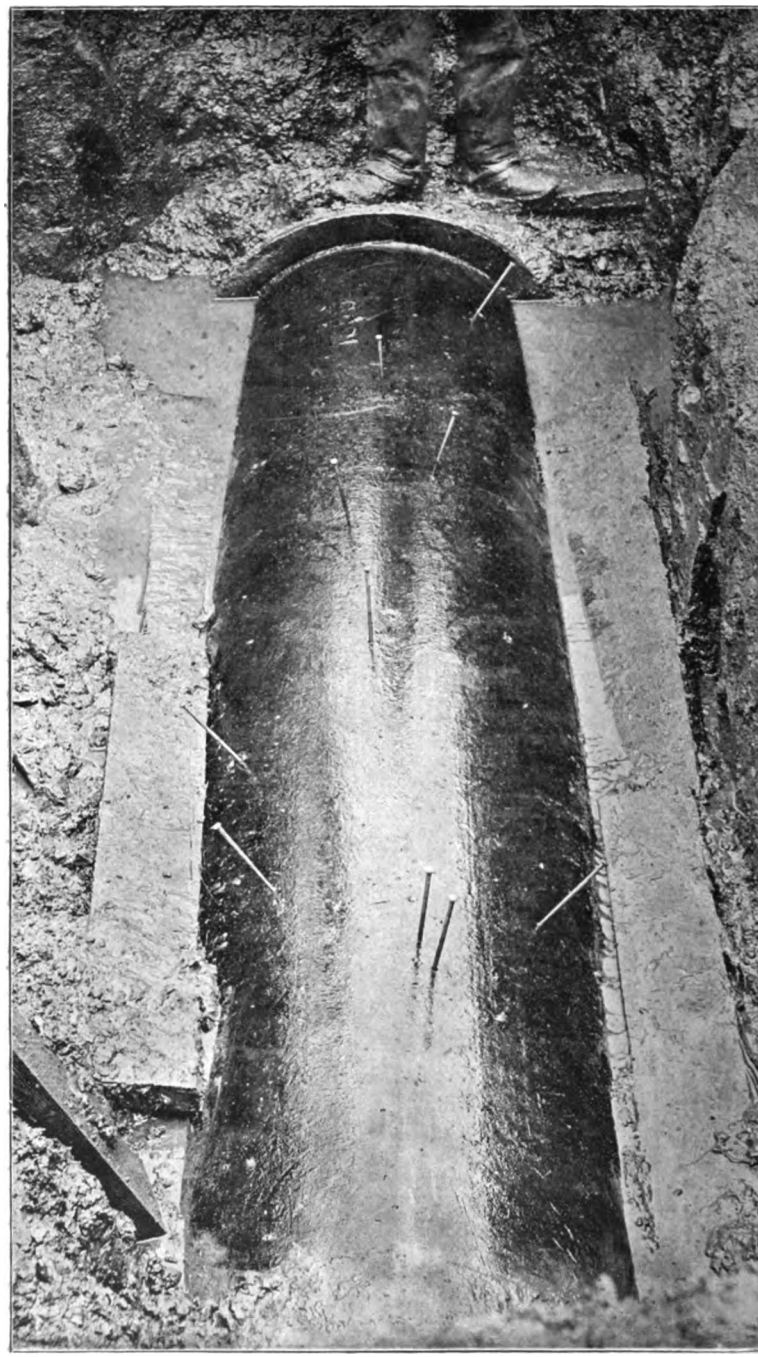

FIG. 3—A THIRTY-SIX-INCH MAIN AT VANDEVENTER AND SHAW AVENUES.
(VERY CRITICAL; LAID 1896.)

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standard electrical resistance. In this manner I was able to accurately get the electrical resistance of the intervening earth, even though a difference of electrical pressure existed between the pipe and the rails.

By the proper use of a large number of storage and dry batteries I was able to perfectly balance my bridge, though there had to be encountered this difference of electrical pressure, which came in the problem as a constant. When the difference of electrical potential was high I used with this bridge low-reading voltmeters, and when the readings were low I used milli-voltmeters. The standard resistances of the lead wires were constants and remained only to be subtracted to give the accurate resistance between pipe and rails, readable directly in ohms.

The greatest danger arises from the liability of burning up the bridge. As a precautionary measure an ammeter was placed in series to find the maximum amount of difference of electrical pressure the micro-ohmmeter would stand, without shunting back through the bridge sufficient current to burn the bridge. The resistance of contacts is thereby completely eliminated in standardizing the resistance between pipes and rails.

In electrical work of this class one must be equipped with a great variety of voltmeters of the low-reading type. If not, the sensibility of the test is completely lost. Sage ohmmeter, combined with Weston voltmeters, will give as accurate results, but the bridge wire is continually burning out. The micro-ohmmeter used in this work will record a resistance from .000001 to 1.0 ohm.

Electrolytic surveys made by simply taking voltmeter readings are both impractical and useless in arriving at the proper conclusions. They must give difference of electrical pressure, standard resistance of the earth, and the calculated current flows, so as to average every 500 feet along all of the lines of electric street railways.

To get extreme low resistances, such as those of large cast iron water mains, no method is so accurate as the above.

Electrically Thawing Out Frozen

the digging up of streets and the building of fires in the excavations, resolved itself into an interesting electrical experiment—cheap, quick and thoroughly efficient. Briefly, the method has been to complete an electric circuit through the frozen water service pipe by attaching one wire of the circuit to the street hydrant and the other to a faucet in the building. The iron pipes being much better electrical conductors than the frozen earth, the electric current followed the pipes and heated them sufficiently to melt the ice in a comparatively short time. In cases where street hydrants were not conveniently located, the circuits were completed by connecting up pipe outlets in two adjoining houses; but in the case of isolated buildings there remained no other way of getting one of the terminals than by digging down at some point in the street, or outside the building, to reach the pipe. Even in this extremity, however, there was not that trouble and delay which attended the old wood or coal fire method, while there was greater certainty of action.

The electric current usually was taken from conveniently located electric lighting circuits, the voltage being reduced to from 20 to 50 volts by means of portable step-down transformers carried on wagons, and for further regulation of current and pressure suitable resistances were employed. In some instances portable generating sets were employed, consisting of steam or gas engine-driven generators, with their accessories, and in still other cases storage battery outfits, moved about from place to place on wagons, were used for the work. In at least one instance, it is interesting to note, the best part of a day was wasted in the attempt to thaw out electrically what seemed to be an unusually refractory pipe, before it was learned that earthenware water mains—non-conductors of electricity—were used in that particular place. That is the only case in which the electric process is known to have been a failure.—Cassier's Magazine.

Water Purification at Quincy, Ill.

Having recently been required to make

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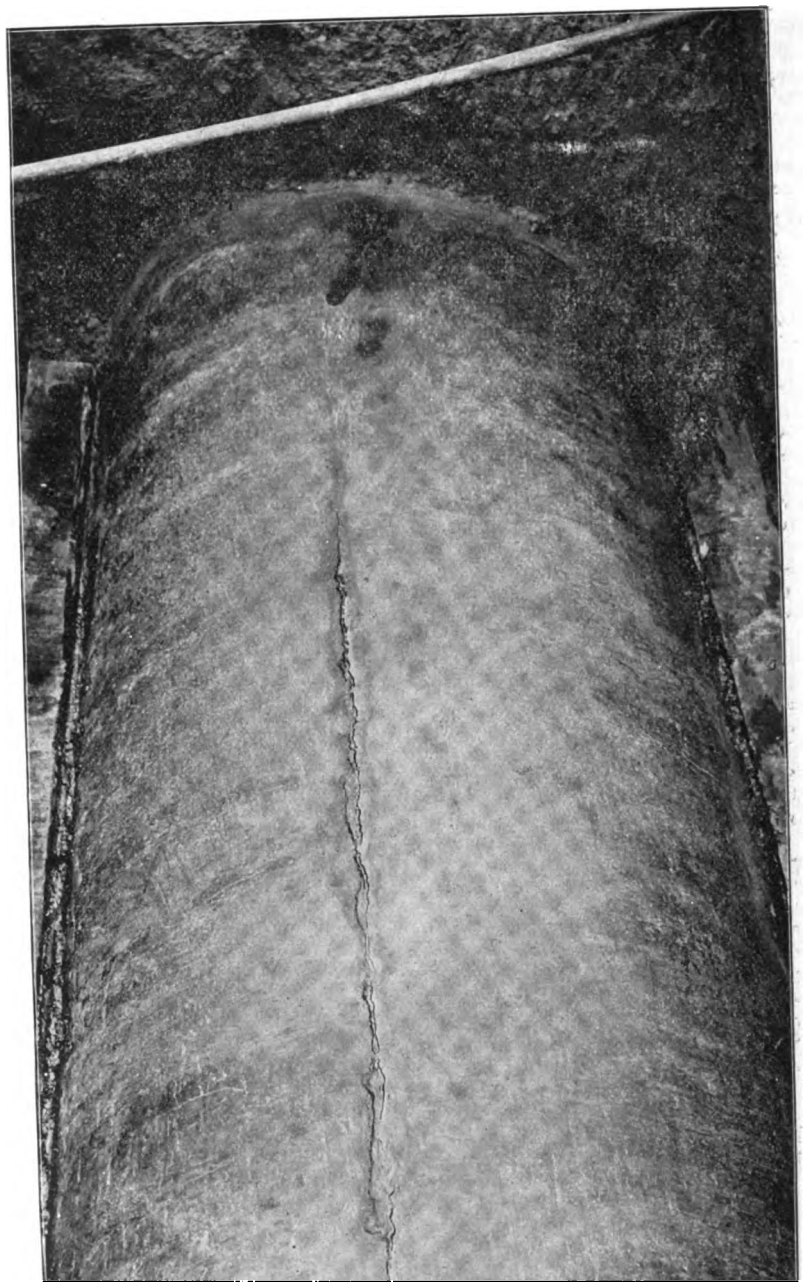

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of ferrous sulphate and lime water. This combination of chemicals is introduced into the water for the purpose of coagulating the matter held in suspension as found in the water taken from the river and to soften the water at the same time. The lime water is secured by slaking lime in large receptacles built over the lime solution tanks and the iron solution is produced by dissolving sulphate of iron crystals in water at a rate determined by analysis.

The water flows by gravity through a thirty-inch conduit from a point about opposite of the north line of Broadway and 400 or 500 feet out in the river, to the intake well at the pump house, at the foot of Main-st. From this well it is raised by a low-pressure pump to the subsidence basin on the east side of the alley between Front and Second-sts. and Maine and Hampshire-sts.

The water as it passes through the low-pressure pump has the proper proportion of iron solution introduced into it to coagulate the matter held in suspension. The specific gravity of the iron held in solution aids sedimentation, and it requires only about one and one-half hours for the water to pass through the various compartments in this basin and back to the west side and at that point it weirs out into a steel trough and flows back by gravity across the alley to the filter house and percolates through approximately three feet of washed sand in fourteen large Jewell filters. These filters are built over clear wells or channels. From these channels it flows back by gravity to the pump house at the foot of Maine-st. and is taken up by the high-pressure pumps and forced to the reservoir or into the mains.

The reservoir is located at Twenty-second and Chestnut-sts and has a capacity of 20,000,000 gallons. It has a roof over it supported by 2x6 timbers twenty-two feet in length set on 462 stone-capped brick piers and cross-braced with 2x6 pieces. This roof was built to exclude the sunlight. There is a class of plants knows to botanists as algae, commonly called marine plants. Filtered water usually contains nutrient salts, and water of this character is subject to rapid pollution by decomposing algae. This class of plants cannot exist without sunlight; hence the roof is required.

The effect on the human system of these weeds is not known to be dangerous, but the effect on the mind of one who drinks water contaminated by algae is similar to one approaching dead animals, and it is hard to convince one that they have not been poisoned after drinking it. Water companies that have met this condition are forced to adopt some plan and they hesitate to adopt the roof, as the first cost, coupled with the cost of maintenance and the attention in winter are all burdens that they do not like to assume.

Tullahoma,, Tenn., Water and Light Plant.

By Granbery Jackson.

In view of the fact that the Tullahoma installation is perhaps the first case on record in the South of a small municipality's supplying its citizens with water and light, with the source of power at such distance from the town as to require what is ordinarily termed a "high-voltage transmission line," a brief history and description of the plant, together with some observations and figures on the results obtained after several months' operation, were presented to the Engineers' Association of the South. It was the usual case of making the best use of the money in hand, rather than a clear-cut engineering proposition.

Tullahoma is a town of about 3,000 inhabitants, located on the Nashville, Chattanooga & St. Louis Railway, nearly midway between Nashville and Chattanooga.

Prior to the establishment of the present system nothing in the line of waterworks had been constructed; but for several years there had been operated by sundry private corporations and individuals a small alternating current electric light plant, with which the city contracted for a few electric lights. For some time this plant was profitable and gave fairly satisfactory service; but, like most privately owned plants in small towns, the service gradually became so poor and unsatisfactory that the city contract was withdrawn and operation of the plant entirely discontinued.

In June, 1901, a bond issue of $35,000 was voted for a municipal water and light plant. Before plans were completed the Water and Light Commissioners of Winchester (a town about sixteen miles by rail from Tullahoma) proposed to furnish power to Tullahoma from its water-power plant, then just beginning construction at "Horseshoe Bend," on Elk River, at a point about ten and a half miles from Tullahoma and about four miles from Winchester. Under the con-

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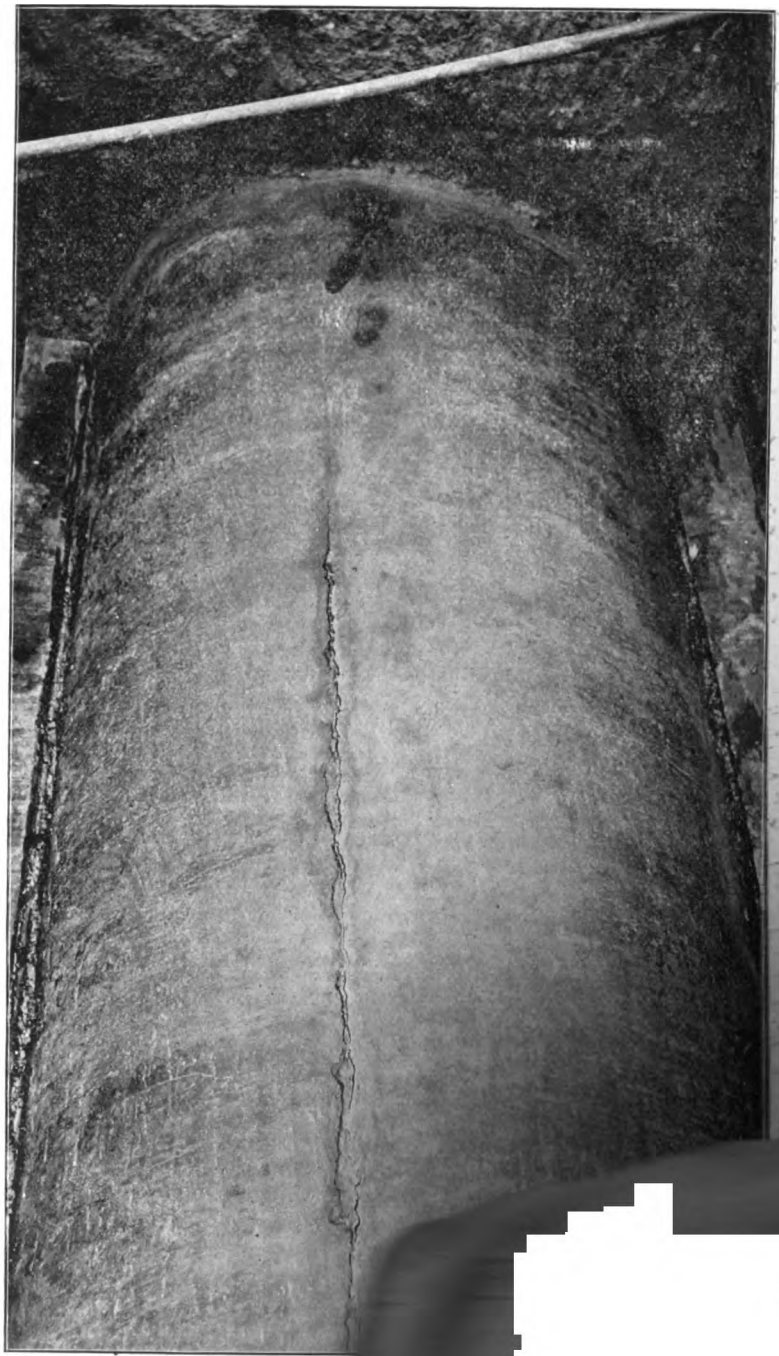

FIG. 4—A FORTY-EIGHTY-INCH MAIN
(GENE

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of ferrous sulphate and lime water. This combination of chemicals is introduced into the water for the purpose of coagulating the matter held in suspension as found in the water taken from the river and to soften the water at the same time. The lime water is secured by slaking lime in large receptacles built over the lime solution tanks and the iron solution is produced by dissolving sulphate of iron crystals in water at a rate determined by analysis.

The water flows by gravity through a thirty-inch conduit from a point about opposite of the north line of Brookside and 400 or 500 feet out in the river to the intake well at the pump house at the foot of Main-st. From this well it is raised by a low-pressure pump to the subsidence basin on the east side of the alley between Front and Second-sts and Maine and Hampshire-sts.

The water as it passes through the low-pressure pump has the proper proportion of iron solution introduced into it to coagulate the matter held in suspension. The specific gravity of the iron held in solution aids sedimentation, and it requires only about one and one-half hours for the water to pass through the various compartments in this basin and back to the west side and at that point it weirs out into a steel trough and flows back by gravity across the alley to the filter house and percolates through approximately three feet of washed sand in fourteen large Jewell filters. These filters are built over clear wells or channels. From these channels it flows now by gravity to the pump house at the foot of Maine-st. and is taken up by the high-pressure pumps and forced to the reservoir or into the mains.

The reservoir is located at Twenty-second and Chestnut-sts and has a capacity of 20,000,000 gallons. It has a roof over it supported by 2x6 timbers twenty-two feet in length set on 42 stone-capped brick piers cross-braced with [illegible] pieces. [illegible] built to [illegible] the [illegible] is a view of [illegible] known [illegible] plants. Filters [illegible]

[illegible]

[illegible]

[illegible]

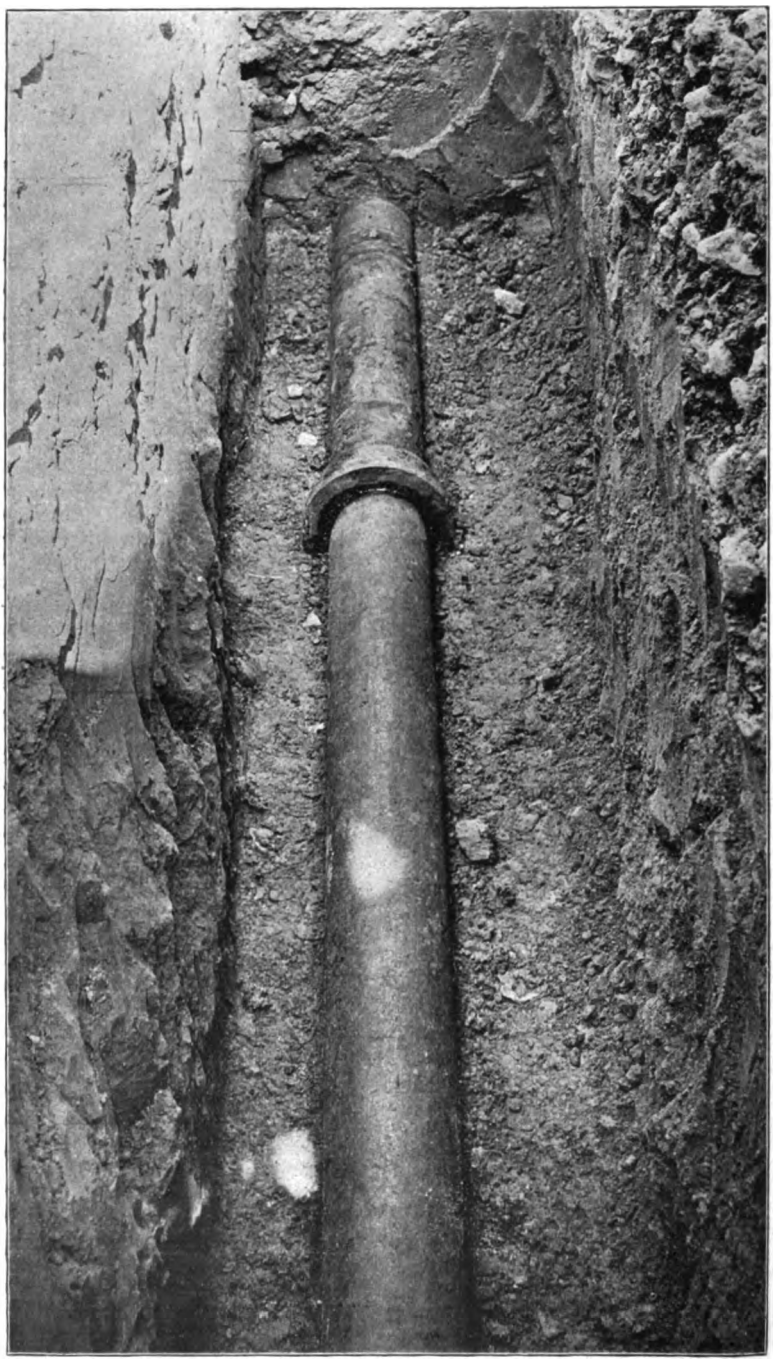

FIG. 5—A SIX-INCH MAIN AT ELEVENTH AND SALISBURY STREETS.
(SLIGHTLY CORRODED.)

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tract, Winchester was to furnish current at machine voltage, delivering to its own switch board in the power house and leaving Tullahoma to construct and operate the ten and a half mile transmission line from that point to the Tullahoma substation. The contract price agreed upon was $100 per month for all current necessary to do the Tullahoma pumping, and, in addition, operate arc and incandescent lamps, whose combined equivalent was 1,250 16-candle power incandescent lamps. The price for 16-candle-power lamps in excess of 1,250 was fixed at 10 cents per month, and water and light service was to be confined to the inhabitants of Tullahoma for public and private use.

The Winchester power plant was built after plans by Kirkpatrick & Johnson of Jackson, Miss. The power is obtained by taking advantage of a loop in the river which, after making a circuit of several miles, at this point approaches within 70 feet of its course, with a natural difference in level at low water of nearly 8 feet. By excavating a canal through the backbone of rock separating the two channels and throwing a concrete dam across the river bed on the upper side, just below the canal, a maximum head of 19½ feet at low water was obtained. The concrete dam was 122 feet in length; 17.8 feet in height; top width, 4 feet; bottom width, 13 feet; the up-stream face being vertical. The end next to the power house was connected without change in section direct to the rock bluff; at the other end a concrete abutment was built perpendicular to the dam, or parallel to the axis of the stream. The top of this abutment was several feet above the top of the dam, and an earth levee was thrown up to connect the abutment with the high ground not subject to overflow, several hundred feet distant.

The engineers state that the plant will develop continuously at low water 170 horse power; by ponding the water and using the surplus during a 10-hour run, the horse power of the plant is materially increased, and believed to be sufficient for the water and light plants in the two towns. During periods of high water the head is reduced, but never gets below thirteen feet and is more than offset by the increased flow of the stream. The wheels installed have a total capacity of 400 horse power.

The total cost of the power plant was about $13,600, exclusive of engineering, divided as follows: Concrete dam and abutment, $6,100; excavating canal, $1,700; penstocks, $1,000; wheels, governor, shafting, etc., $2,000; building, $500; levee, $800; property, $1,500. Electrical machinery is not included.

The electrical equipment for generating the current consists of two 100-k.w., three-phase, compound-wound, revolving field, alternating-current generators. The current is delivered to the switch boards at 2,300 volts, at which pressure it is delivered over a four-mile transmission line into Winchester, and there used for arc and incandescent lighting, and also, by means of an induction motor, for pumping the city's water supply.

For transmission to Tullahoma, it was decided to step up from the machine voltage to 10,000 volts; and three thirty-five-k.w., oil-cooled transformers were installed in the power house for this purpose.

Red-cedar poles, twenty-five feet in length, forty poles to the mile, were used, each pole carrying a standard, two-pin cross arm, fastened to the pole with two seven-inch lag screws. This arm was located about twenty-four inches below the top of the pole, and carried two of the wires, the third wire being carried by a pin set in a hole bored squarely in the top of the pole. This brought the three wires relatively at the vertices of an equilateral triangle, whose sides were about thirty inches in length; and the arrangement gave a neat-looking and balanced pole line. To prevent the splitting of the pole by the strain on the top pin, the pole was tightly wrapped at that point with a half-dozen or more turns of galvanized iron wire, above which it was neatly coned up to the base of the pin. The pins were the standard one and one-half-inch locust, thoroughly painted. The poles, before setting, were neatly trimmed of all knots and smoothly shaved with a drawing knife. The portion in the ground was thoroughly coated with carbolineum avenarius. The insulators were of glass, with triple petticoats, and guaranteed by the makers to give satisfactory service under 10,000 volts.

The wiring consisted of three No. 6 bare copper wires, tied securely to the insulators with the same material. To counteract the effect of induction on the wires of the Cumberland Telephone Company, which for seven miles ran parallel to, and not more than five or six feet distant from, the electric wires, the latter were transposed by revolving them spirally, with reference to the pins, one

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FIG. 6—ELECTROLYZED CAST IRON GAS MAIN TAKEN FROM GEYER AVENUE, TO WHICH LINE OF PIPE THE "DRAINAGE SYSTEM" HAS ALWAYS BEEN APPLIED 1980 FEET DISTANT. IT SHOWS WHAT AN UTTER FOLLY THIS REMEDY IS.

FIG. 7—CAST IRON GAS MAIN COMPLETELY DESTROYED BY ELECTROLYTIC ACTION.

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pin every fifteen poles, or a complete revolution or transposition every mile and a half. This was found to accomplish the desired result, and no serious inductive effect was noticed, even on a telephone line placed on brackets about eighteen inches below the cross arm of the transmission poles themselves. This telephone line connecting the power house to the Tullahoma substation has proved a very useful and necessary adjunct in the operation of the plant.

The substation at Tullahoma is located within a half block of the principal business district. It is a plain, brick building, twenty feet by thirty feet in plan. The 10,000-volt wires are connected on the pole nearest the building to heavily-insulated, lead-covered wires led to a 10,-volt oil switch, stationed a few feet behind the switch board and incased in brickwork.

From the oil switch the wires are led outside the building to the step-down transformers, which are located in a transformer house separate from the substation. The transformers are six in number, three of twenty-k.w. each and three of 15-k.w. each. The larger set reduces the voltage back to 2,300, at which pressure the current is carried back to the switch board and thence sent out over two independent circuits for incandescent lighting, and through a constant-current transformer and series arc circuit for street-lighting service. Distributed over the pole line as needed are the regulation transformers for a further reduction of voltage to 110 for the incandescent lamps.

The three fifteen-k.w. transformers reduce the voltage direct from 10,000 volts to 200 volts for use by two fifty-horse power induction motors, one of which drives the air compressor for an air-lift pumping system; the other, a vertical triplex water-works pump. These transformers are also made to serve in the capacity of "station transformers" for lighting the station by using 220-volt lamps.

Thirty series enclosed arc lamps are installed for street lighting, four of these being placed on a 100-foot light tower, located in the middle of the principal business street. This light tower is the only item of the old plant which was retained in use.

The water supply is from deep wells. An 8-inch well was drilled within 100 feet of the station, 120 feet deep, which, when tested with a 4-inch cylinder pump, yielded the capacity of the pump, 100 gallons per minute, with a reduction in head of only six feet. It was then decided that two such wells, chambered out to a total depth of 200 feet to allow proper submergence for the air-lift pipes, would yield a sufficient quantity of water to supply the town. The two wells were not far enough apart to prevent one being slightly affected while the other was being pumped.

For pumping into a surface reservoir, the air-lift system was adopted as being best suited to the existing conditions; and a 12x12-inch duplex, single-stage compressor, arranged for belting to one of the 50-horse-power motors, was installed in the station. After the installation was completed the wells were tested, and yielded continuously at the rate of 25,000 gallons per hour, the water being of excellent quality. Continued use of the wells since completion has increased the yield to a perceptible extent.

The wells discharge into a covered circular brick reservoir, or basin, of 80,000 gallons capacity—the diameter being thirty feet; the depth, fifteen feet. From this the water is delivered to the elevated tank and distribution system by means of a vertical triplex pump of 750,000 gallons capacity per twenty-four hours, directly connected by double-reduction gears, to a 50 horse-power induction motor.

The distribution system comprises about six miles of 4, 6 and 8-inch standard cast-iron pipe, to which are connected fifty-one double-nozzle "Corey" fire hydrants. Within 200 feet of the station and connected to the system by an 8-inch pipe is a steel tower and tank of 75,000 gallons capacity, having a total height above capstones of 120 feet, exclusive of a conical metal roof. The tank and tower is of the type originally introduced by the Chicago Bridge and Iron Company, the tank having a hemispherical bottom and being supported on four columns, each of which is built of two channels double-laced together.

The total cost of the Tullahoma plant, beginning with the step-up transformers at the power house, was $39,486, divided approximately as follows: Pipe system, including valves and hydrants, $13,240; tower and tanks, $3,995; electrical apparatus, $6,257; transmission line and other electrical construction, $7,628; wells, $1,-250; air-lift plant, $2,000; triplex pump, $1,550; reservoir, $948; buildings, $738; engineering and superintendence, $1,880.

The work was carried out under ten separate and distinct contracts, instead

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FIG. 8—GENERAL DESTRUCTION OF CAST IRON GAS MAIN BY ELECTOLYSIS.

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of by the usual method of letting the whole work to one general contractor. This subdivision of contracts undoubtedly resulted in reducing the total cost of the plant as compared with what it would have been if the contract had been let to the lowest bidder on all sections combined; but it is questionable whether this gain was not more than offset by the several contractors requiring more time in which to complete the work than would have been the case with the work all in one man's hands.

The operation of the plant has been remarkably successful both electrically and financially. Within a few days after the plant was put into operation and while the elevated tank was temporarily empty and being painted on the inside, a fire broke out in the heart of the business section at 3 o'clock in the afternoon. The power plant at the river was shut down for the day, the Tullahoma superintendent was nearly a mile away from the substation busy with inside wiring work, the substation was locked and the newly-purchased fire hose and nozzles were only partially unboxed, with nothing whatever in the shape of an organized fire department. The Mayor and one or two members of the commission broke into the station, telephoned the operator at the river to turn on the current, got some of the hose connected to the nearest hydrant, started up the triplex pump and in spite of all the necessary delays and lack of organization the fire was put under control, and several other houses which had caught fire from flying sparks, were extinguished without damage. It is the general opinion of all who saw the fire that the plant was the means of saving, in this one instance, property of more value than the entire cost of the system.

Estimates for operation in January, 1903: Total receipts, $338.02; total expense, $205; January net revenue, $133.02; fixed charges: January interest (4½ per cent on $40,000), $150; January depreciation (5 per cent on $40,000), $166.67; total, $316.67.

Deducting the net revenue we have $183.65 representing the cost to the city of its public light and water service, as furnished by thirty series inclosed arc lamps and fifty-one fire hydrants. With no allowance for increase and assuming the January run to be an average for twelve months, we find the yearly cost of the public service to be $2,203.80. The same service, when figured at the average rates paid elsewhere—viz., $75 per year for arc lamps and $50 for hydrants—would cost $4,800, or over twice the above.

It should be noted, also, that the rates charged for incandescent lights are very low, the January average rate being 38 cents; the average meter rate 23 1-10 cents per lamp per month. The meter rate is 12 cents per k. w. hour.

The superintendent reports new lights constantly going in, and it is not unreasonable to assume that in the course of a few months the light revenues will be increased at least 25 per cent, also that the water revenues will amount to at least $150 per month before the expiration of the present year. This would bring the total net revenues up to $320 per month, or slightly in excess of the interest and depreciation account, thus making the plant self-sustaining, with the public service (equivalent in value to $4,800 per year) practically free of all cost.

An analysis of the January figures, with reference to the lighting plant alone, gives the following:

Gross receipts from lighting service	$300 07
Operation expense for entire plant	205 00
Net revenue	$ 95 07
Interest (at 4½ per cent on $15,000)	56 25
Depreciation (at 10 per cent on $15,000)	125 00
Total	$181 25

Deducting the net revenue, we have $86.18 as the monthly cost of thirty arc lamps, which is equivalent to $2.87 per lamp per month, or $34.44 per lamp per year.

Assuming a probable increase of 25 per cent in the light revenues, the net profit per month will fall short of the interest and depreciation account only $11.18 per month, reducing the cost of the street light service to $4.48 per lamp per year. It should be noted, also, that the entire cost of operating both plants is, in this case, charged to the light department alone. This is done for the reason that it would probably cost very little less to operate the electric light plant alone than it now does to operate both plants together.

With the operation of the plant in the hands of a first-class superintendent and the general management of its affairs intrusted to three reliable Water and Light Commissioners, none of whom are members of the Board of Mayor and Aldermen, there seems no reason why it should not prove a very satisfactory and profit-

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FIG. 9—A TWO-INCH WROUGHT IRON SERVICE PIPE DESTROYED BY ELECTROLYSIS IN 487 DAYS, ON MANCHESTER AVE., NEAR CHOUTEAU AVE.

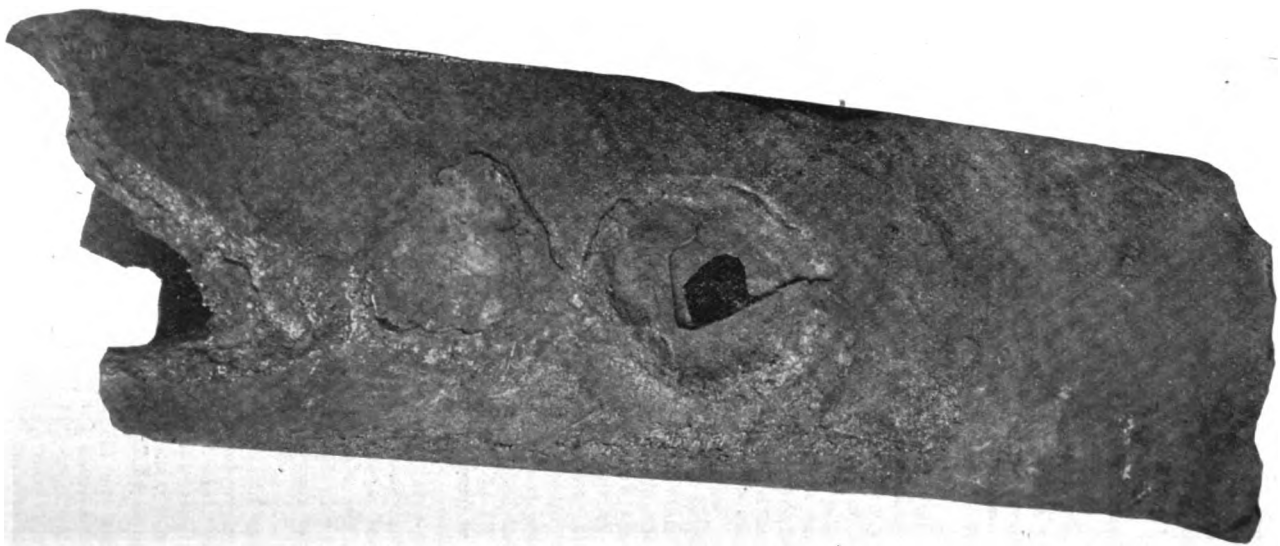

FIG. 10—THE PITTING EFFECT OF ELECTROLYTIC ACTION UPON CAST IRON GAS MAIN.

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able addition to the public property of the citizens of Tullahoma, besides helping to demonstrate the importance and value of many hitherto neglected water powers in the South, even though they may be located at considerable distance from railroads and towns in which the power may be utilized.

The Raising of Water by Compressed Air.

At a recent meeting of the British Association of Water-Works Engineers William H. Maxwell, borough and waterworks engineer of Tunbridge Wells, read a paper on the use of compressed air in raising water from deep wells and borings from which the following is taken to show the advantages and limitations of this method of lifting water.

The successful adoption of the system of raising water by the use of compressed air is dependent upon the conditions peculiar to the case under treatment, and it is therefore essential that the waterworks engineer, before resorting thereto, should carefully consider whether the special circumstances of the case are such as to fully warrant its adoption, and the author hopes in the course of the present paper to point out from his own experience what he believes to be the special circumstances to which the system is particularly applicable. Before referring to the details of the plant under the author's charge, it will be convenient to briefly review some of the general principles governing the operation of compressed air in raising water.

The experiments carried out in the United States by Dr. Pohle of Arizona, who for some years past has been engaged in the application and development of this system for raising water, oil and other liquids from underground sources, have proved that the main principle upon which the system operates is the following: Air under the necessary pressure and of suitable volume is admitted to the bottom of a pipe immersed in the water to be lifted. By this means alternate bands or columns of air and water are formed in the water pipe or "raising main" and the air does not, as might perhaps have been anticipated, pass through the mass of water. The result of this is that the aggregate weight of the water in the rising main is insufficient to balance the column of water in the boring, and the pressure of the latter therefore produces an upward movement of the air and water column in the rising main. As the force lifting this column is the head of water at the outlet of the air pipe, it follows that the hight to which the water can be lifted depends upon the depth to which the pipe is immersed below the pumping level of water in the boring. Thus the higher the "lift" required the deeper must be the point at which the air is injected relatively to the normal water level therein, and consequently the hight to which the water has to be raised determines the minimum depth to which the boring must be driven.

With regard to the best proportion between the immersion of the air nozzle and the "lift" of the water, opinions vary, but the author found that in his case the most economical result was obtained when the ratio was three (of immersion) to one (of lift) at the start, and two and two-tenths to one at the finish of the test. Under these conditions the efficiency worked out at 36.8 per cent calculated from the steam diagram, and at 46 per cent calculated from the compressor diagram, the volumes of air used and water lifted being in the proportion of 2.69 of the former to one of the latter.

From the results of his own tests and those of others, the author has prepared the following table showing the approximate horse-power required to compress 1 cubic foot of free air to different pressures per square inch:

	Pressure in pounds per square inch.	Horse power required to compress 1 cubic foot of air.
(1) Solvay works, Saaralben	176	0.434
(2) Brostowe estate, near Friedheim	140	0.376
(3) Tunbridge Wells waterworks	100	0.201
(4) Ditto	80	0.189
(5) Ditto	60	0.159
(6) Sugar factory, Glogan	45	0.145
(7) Yard works, Zwickau	30	0.121
(8) Rossland mines, B. C.	95	0.134*

*This excellent result was probably due to the use of inter-coolers.

With regard to the quantity of air required to lift a given volume of water to any specified hight, the author has found the following formula to give results in accordance with his own experience:

The number of cubic feet of free air

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required per minute, equals the number of gallons of water required per minute multiplied by the "lift" of water in feet and divided by the constant 125.

From this formula it is, of course, a simple matter to ascertain the quantity of water that can be lifted to any given hight by a given quantity of air.

With regard to the proportions between the areas of the air pipe and the rising main, the author considers that further experiments are required before it can be decided what proportions will secure the most economical results in practice; it is evident that the velocity of the water in the rising main is an important factor in this case, but as regards the air pipe the author considers that the velocity of the air should not exceed about 20 feet per second.

It has occurred to the author, as it has no doubt to others who have watched an air-lift plant in operation, that the excessive velocity and force of the discharge must involve a considerable waste of energy, and that some appreciable economy would be effected were it possible to utilize this force in any practical way.

In considering the design of the compressor, it is obviously important in the interests of economy to provide either "two-stage" or "three-stage" machines (with inter-coolers) according to the amount of compression required; thus for pressures above 60 lb. per square inch and up to 300 lb. per square inch "two-stage" machines are most suitable, and from this to 1,000 lb. per square inch "three-stage" machines are desirable. The cooling of the air is also of great importance in this respect, and care should be taken to start with an air supply at the lowest temperature obtainable.

At Tunbridge Wells the compression is caried out in two stages, the first to a pressure of 25 lb. per square inch, and the second, after inter-cooling, to the pressure required, which varies from 90 lb. to 100 lb. per square inch according to the depth of the water in the boring. The air is delivered into a large steel receiver situated in the engine-house, whence it is conveyed to the wells by means of a 4-in. cast-iron pipe. This main is formed of ordinary spigot and socket pipes with lead joints, which, however, shortly after starting the plant showed signs of leakage adjacent to the receiver. This was traced to the expansion and contraction of the pipes due to the high temperature of the air, and was effectually prevented by fixing a cooler on the air pipe between the second stage compressor and the receiver.

There are two sets of engines and compressors designed to deliver a sufficient volume of air to lift the desired quantity of water, if needs be, over a stand-pipe 20 ft. high above ground level. The engines are compound, with cylinders 8 in. and 13 in. diameter respectively, the air-compressing cylinders being 10 in. (first stage) and 6 in. (second stage) diameter respectively. The stroke in each case is 14 in. The air-cylinders are water-jacketed at sides and covers. The clearance in the air-cylinders does not exceed 1 per cent of the capacity. The air is drawn from outside the building, and is carried in an earthenware pipe under the floor to the inlet valves, so that it enters the compressors at the lowest possible temperature.

The inter-cooler (between first and second stages of compressors) is formed of a series of "Rows" tubes cooled by circulating water. This is also fixed outside the engine-house.

Provision is made for draining off the water which is precipitated in the receiver owing to the compression of the air, and, similarly, any oil carried forward by the air from the cylinders is also precipitated here, and drained away from time to time. As a further safeguard, another trap is provided near the boring for the same purpose. In some cases, however, the receiver is filled with coke in order to arrest any oil carried forward with the air.

The boring is 350 ft. deep, penetrating the Wadhurst clay to a depth of 204 ft. 6 in., and the Ashdown sands to a further depth of 145 ft. 6 in. The upper portion is lined with 15-in. steel tubes, and the lower portion (150 ft.) with steel perforated tubes, 12½ in. in diameter. The rest level of the water is about 96 ft. from the surface, and the pumping level, when drawing at the rate of 32,000 gallons per hour, is about 120 ft. from the surface, but on the cessation of pumping the water resumes its rest level very rapidly.

The water pipe or rising main is 7 in. in diameter, and is carried to within a few feet of the bottom of the boring. The air pipe was originally 1½ in. in diameter, but was subsequently increased to 2½ in. in diameter, an alteration which reduced the air prsesure required from 105 lb. to 91 lb. per square inch, the latter figure corresponding very closely to the head of water above the bottom of the air

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pipe, and thus proving the loss by friction to be reduced to a minimum.

In a trial run for ten and a quarter hours made soon after the plant was installed an average of 31,402 gallons per hour was raised from this boring under a head of 133 ft., whereas an ordinary single-acting pump, such as could be fixed in a boring of this small diameter, would not give more than about 18,300 gallons per hour.

In a table the author has given a summary of the results obtained by tests at various times and under different conditions of water level, which he believes will prove interesting. Here it will be seen that the most favorable result was obtained in Trial 1, when the proportion of immersion of air pipe to lift of water was 2 to 1 at the start and 22 to 1 at the finish, the volume of air used per volume of water lifted being in the proportion of 2.69 to 1. The efficiency in this case was 36.8 per cent, calculated on the water raised proportionate to the indicated horse-power developed in steam-cylinders, and 46 per cent. calculated from the indicated horse-power shown by air-cylinder diagrams. Unfortunately, on this occasion the fuel consumption was not recorded, so that the cost per 1,000 gallons of water raised could not be obtained.

From Trial No. 5, however, with a much less immersion of air pipe, and when the proportion of air used to water lifted was more than double that in the former case, the cost of fuel worked out at 1.073 pence per 1,000 gallons for a maximum lift of 125 ft. 9 in., the price of coal being 25s 5d per ton.

During the earlier months of the present year, with water levels varying between the depths of 98 ft. and 118 ft. below surface, under regular working conditions the fuel cost came out at a fraction under 1d per 1,000 gallons raised.

The comparatively unfavorable results shown in Trial 4 were accounted by the fact that at this time the water level was at an unusual depth, and the ratio of immersion to lift was consequently reduced to 1.13 to 1 (end of trial). On this occasion a test was being made of the maximum yield of the strata, and all the wells and borings were being drawn upon to the utmost possible extent. In this case the quantity of air required per unit of water lifted rose to a proportion of 8.4 to 1, and the "efficiency" fell to 17.7 per cent. on the indicated horse-power in steam-cylinders and 22 per cent. on indicated horse-power in air-cylinders. The cost of fuel (at 25s 5d per ton, as before) worked out at 1.53d per 1,000 gallons raised. The author has given this result for the purpose of showing the effect of reducing the proportion of immersion to lift, but of course these figures must not be taken as representing the working of the plant under ordinary and fair conditions.

In Trial 7 the efficiency worked out at 26.1 per cent. on steam-cylinder diagram, and 32.5 per cent. on air-cylinder diagram.

Comparison Between Different Systems of Pumping.—Having to provide pumping plant for a boring 15½ in. in diameter and 400 ft. deep, situated in an isolated and somewhat inaccessible position, the author has made a careful estimate of the comparative cost of pumping and maintenance with the three alternatives of (1) air-lift, (2) steam engine, and (3) oil engine—both the latter operating ordinary borehole pumps, and in each case taking into account the capital charges involved. The results are shown in the following statement, the lift being assumed as 100 ft., and the working hours 3,000 per annum:

(1) Compressed-Air Plant.

	Per 1,000 Gallons.
Capital charges, labor and repairs..	1.16d.
Fuel as per test Oct. 7, 1902.....	1.073d.
Total	2.233d.

(2) Steam-Engine and Borehole Pump.

	Per 1,000 Gallons.
Capital charges, labor and repairs..	2.4d.
Fuel (average of tests by the author)	0.5d.
Total	2.9d.

(3) Cheap Fuel Oil-Engine and Borehole Pump.

	Per 1,000 Gallons.
Capital charges, labor and repairs..	1:53d.
Crude oil fuel.....	0.25d.
Total	1.78d.

Advantages and Disadvantages of Air-Lift System.—In conclusion, the author will summarize some of the most important general features of the air-lift system as ascertained from his own experience. The most suitable conditions under which the system may be applied appear to be those which exist at Tunbridge Wells—viz., where a boring is situated in an isolated and somewhat inaccessible position, and the air-compressing plant can be placed on an existing pumping station, involving but little outlay in the erection of new foundations or buildings, or the purchase of additional land, and without incurring the provision of additional labor at the site of the bor-

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ing. To secure satisfactory results, however, it is important that the difference between the rest level and the pumping level of the water should not be excessive, that the fluctuations of the same should be ascertained beforehand, and that the ratio between the immersion of the air pipe and the total lift of the water should be adjusted to the most suitable proportions, and not greatly varied in ordinary working.

Although it cannot be denied that the cost of fuel involved by the air-lift exceeds that required with a steam or oil driven pump of the ordinary form, yet the author believes that, under suitable conditions, the former will prove to be preferable, taking all charges into account in each case. The absence of any moving parts in the boring secures a great reduction in the cost of repairs and maintenance, as well as in supervision and all other charges incidental to an additional pumping station. There is also a great advantage in the use of the air-lift in cases where the water contains iron, as the aeration is carried out very thoroughly in the boring, and, after the water has reached the surface, the precipitation of the iron takes place more speedily. On the other hand, the system is by no means suitable to all circumstances and

TESTS OF "AIR-LIFT"—TUNBRIDGE WELLS WATER-WORKS.

1	2	3	4	5	6	7	8	9	10
Date of Test.	No. of test.	Water levels below ground surface. Start.	Finish	Average rate of delivery per hour in gallons.	Cubic feet of water delivered per minute.	Cu. ft. of air per minute (atmospheric pressure).	Volumes of free air to 1 of water.	Ratio of immersion of air-pipe to lift. At start.	At finish.
		ft. in.	ft. in.						
June 3, 1901	1	84 0	106 0	24,100	64.3	178.6	2.69	3.01 to 1	2.2 to 1
April 11-17, 1901	2	89 0	139 0	29,055	77.5	377	4.8	2.8 to 1	1.6 to 1
July (latter part) 1901	3	94 0	124 0	30,446	81.2	285.3	3.5	2.6 to 1	1.72 to 1
July 14-20, 1902	4	120 0	158 6	19,785	52.8	447	8.4	1.8 to 1	1.13 to 1
October 7, 1902	5	103 9	125 9	27,636	73.7	421.8	5.7	2.27 to 1	1.69 to 1
October 21, 1902	6	109 7	124 6	27,187	82.7	398	5.4	2.1 to 1	1.71 to 1
February 12, 1903	7	96 6	112 8	26,289	70.1	260.5	3.7	2 46 to 1	1.96 to 1

NOTE.—The fuel cost per 1,000 gallons raised, Test No. 5, with water levels varying between 103ft. 9in. and 125ft. 9in., was 1.073d., with coal at 25s. 5d. per ton. During the early months of the present year (1903), with water levels between 98ft. and 118ft. below surface, the fuel cost was .97d. per 1,000 gallons.

Thawing Frozen Pipes by Electricity.

The use of electricity for thawing out frozen water pipes has been resorted to quite generally this winter in a number of towns and cities. Newark, N. J., claims to be the first eastern city to put the method into practical daily use, and when it became evident that it was a successful and economical method, officials of water departments in other cities began making inquiries regarding it. New York City is credited with having sent an electrician to Newark to investigate, and as a result decided to give the method a trial in Gotham. A representative from Trenton, N. J., also visited Newark to investigate the method, while letters of inquiry were received from Paterson, Passaic, Elizabeth, New Brunswick, Rahway and Philadelphia.

The water department at Rockford, Ill., successfully thawed with electricity the many sections of water mains that were frozen solid in that city.

Meters Recommended for Lestershire.

In his annual report F. L. Faats, superintendent of water works at Lestershire, N. Y., recommends that water meters be installed on all service pipes. He also

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CEMENT AND CONCRETE

Indianapolis Testing Laboratory—Cement Specifications—Proportions in Cement—Impervious Concrete—Concrete Blocks for Manholes—Concrete Blocks in Pittsburg.

The Municipal Testing Laboratory of the City of Indianapolis.*

By Walter Buehler, Assistant City Engineer.

The municipal testing laboratory of the city of Indianapolis, came into existence in the fall of 1902. Prior to that time there was absolutely no systematic testing of any of the material used in construction of work done under the supervision of the City Civil Engineer. It is true that there were tests made of cement, asphalt and oils, but as no record was kept of such tests, they are, of course, valueless at this time.

Mr. James B. Nelson knowing the value of a testing laboratory determined to at least give it a start, and about $400 was expended in buying apparatus for the physical and chemical examination of cement. Later after Mr. Nelson resigned and Mr. B. J. T. Jeup was appointed City Engineer the Laboratory was given a further impetus by the purchase of apparatus for the chemical examination of creosote oils, asphalt and for the examination of the candle power of the artificial gas.

In making tests since the Laboratory has been in existence, I have had in mind the importance of a systematic method of keeping the records of such tests, and in the testing of cement, the value of uniformity of manipulation.

The specifications adopted by the Board of Public Works are taken as a basis for the acceptance or rejection of the cement. The samples of cement are taken from collecting the sample" is placed on file in the Laboratory and afterward copied with the results of the tests into a book printed expressly for that purpose.

The following tests are made of each sample: Fineness, tensile strength, time of initial and final set, soundness, specific gravity and when thought necessary a chemical examination. In determining the fineness, one hundred grams of cement are passed successively through a one hundred, eighty and fifty mesh sieve. The sieve is shaken by hand for ten minutes, the screenings are then weighed and the sieve is shaken again for one minute and the second screenings weighed. If this weight be more than one-tenth (1-10) of a gram the sieve is shaken again, so on till after shaking one minute, less than one-tenth (1-10) of a gram passes through. The combined weight of the screenings is taken as the amount passing through that particular sieve.

Having first determined the proper percentage of water required for the neat tests, this being ascertained by adding a small portion of water from a graduate till a stiff plastic paste is obtained, which will when mounded into a ball, withstand a fall of twenty inches without cracking, twenty ounces of the cement are weighed out and placed upon the mixing table, into which the proper percentage of clean water is poured and the whole thoroughly kneaded to the proper consistency with the hands. It is then placed into the moulds in three layers, each layer rammed thirty times with a brass rod three-quarters of an

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months. The sand used in the three to one and two one tests is Ottawa sea sand passing a twenty sieve and being retained on the thirty.

For determining the time of set, the laboratory is provided with Gilmore needles.

The one-twelfth-inch wire weighted to a quarter of a pound is used for the initial set, the one-twenty-fourth inch needle weighted to one pound is used for the final set. In testing for soundness the hot test, the air test and the water test are used. In the hot test a pat one-half inch thick and three incnes in diameter is exposed to steam for six hours and hot water for eighteen hours. When practical this hot water test is made at the end of the twenty-eight day test. The air test and water test are made on pats which are exposed to air and water for twenty-eight days and studied at regular intervals.

The specific gravity is determined by means of a Candlot specific gravity bottle.

All cements are from time to time subjected to a chemical analysis, for which purpose the laboratory has been equipped in every detail.

Specifications for Cement.

The following are the recently revised specifications for cement adopted by the engineering department of the city of Indianapolis, Ind.:

1. Inspection—All cements shall be inspected, and those rejected shall be immediately removed from the work by the contractor.

2. Storage—On all main sewers, bridges (unless otherwise ordered) and such branch sewers or other work as the City Civil Engineer may designate, shall be provided a suitable house for storing the cement.

3. Protection—Accepted cement, if not used immediately, must be thoroughly protected from the weather, and never placed on the ground without proper blockings, and may be reinspected at any time.

4. Failure—The failure of a shipment of cement on any work to meet these requirements may prohibit further use of the same brand on that work.

The acceptance of a cement to be used shall rest with the Board of Public Works and the City Civil Engineer, and will be based on the following requirements:

—Natural Cement.—

By natural cement is meant one made by calcining natural rock at a heat below incipient fusion and grinding the product to powder.

Weight—Each bag of natural hydraulic cement must contain 150 pounds net; each barrel 300 pounds net.

5. Specific Gravity and Fineness—The cement shall have a specific gravity of not less than 2.9.

Ninety-five (95) per cent by weight must pass through a sieve made of No. 35 wire, Stubbs gauge, 2,500 openings to the square inch.

Eighty (80) per cent by weight must pass through a sieve made of No. 40 wire, Stubbs gauge, 10,000 openings to the square inch.

6. Constancy of Volume—Round pats of neat cement, about three (3) inches in diameter, one-half (½) inches thick at the center and tapering to a feather's edge, mixed in the same manner as the neat cement briquettes and placed on a glass plate, shall not show any signs of warping or cracking after twenty-eight (28) days in either air or water.

7. Time of Setting—The cement shall get its initial set in not less than thirty (30) minutes. This being determined by means of the Vicat needle, from pastes of neat cement of normal consistency, the temperature being between 60 and 70 degrees F.

8. Tensile Strength—Briquettes, one (1) square inch in cross section, shall develop the following ultimate tensile strength:

Ages.	Strength Pounds.
24 hours (in water after hard set).....	90
7 days (1 day in air, 6 in water)	150
28 days (1 day in air, 27 in water).....	250
7 days (1 day in air, 6 in water), 1 cement, 2 standard sand	120
28 days (1 day in air, 27 in water), 1 cement, 2 standard sand	175

—Portland Cement—

The cement shall be a true Portland cement, made by calcining a proper mixture of calcareous and clayey earths, and if desired a certified statement shall be furnished of the chemical composition of the cement, and the raw materials from which it is manufactured. It shall be free from lumps and finely ground.

Weight—Each barrel must at least weigh 400 pounds gross and be properly lined so as to be effectually sealed from dampness.

Specific Gravity and Fineness—The cement shall have specific gravity of not less than 3.1.

Ninety-eight (98) per cent by weight must pass through a sieve made of No. 35 wire, Stubbs gauge, 2,500 openings to the square inch.

Constancy of Volume—Round pats of neat cement about three inches in diameter, one-half inch thick at the center and tapering to a feather's edge, mixed in the same manner as the neat cement briquettes and placed on a glass plate, shall not show any signs of warping or cracking after twenty-eight days in air or water, or when placed six hours in boiling water.

Time of Set—The cement shall get its initial set in not less than thirty minutes, and its final set in not less than fifty minutes nor more than ten hours. The test being made in the same way as for the natural cement.

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Tensile Strength—Briquettes one square inch in cross section shall develop the following ultimate tensile strength:

Ages.	Strength Pounds.
24 hours (in air)	100
7 days (1 in air, 6 in water)	400
28 days (1 in air, 27 in water)	575
7 days (1 in air, 6 in water) 1 of cement, 3 of standard sand	120
28 days (1 in air, 27 in water) 1 of cement, 3 of standard sand	200

Sulphuric Acid and Magnesia—It shall contain not more than one and three-quarters per cent of anhydrous sulphuric acid (SO_3) nor more than 3.5 per cent of magnesia.

—Puzzolan—

By puzzolan cement is meant one made by grinding together without subsequent calcination granulated blast furnace slag with slaked lime.

Weight—The average weight per barrel shall not be less than 330 pounds net, four sacks shall contain one barrel of cement.

Specific Gravity and Fineness—The cement shall have a specific gravity of not less than 2.7.

Ninety-seven per cent. by weight must pass through a sieve made of No. 40 wire, Stubbs gauge, having 10,000 openings to one square inch.

Constancy of Volume—Round pats of neat cement about three inches in diameter, one inch thick at the center and tapering to a feather's edge, mixed in the same manner as the neat cement briquettes, and placed on a glass plate, shall not show any signs of warping or cracking after 28 days in water.

Time of Setting—The cement shall not acquire its initial set in less than 45 minutes, and shall acquire its final set in 10 hours. The test made in same way as natural cement.

Tensile Strength—Briquettes one square inch in cross section shall develop the following tensile strength:

Ages.	Strength.
7 days (1 in air, 6 in water)	350 pounds
28 days (1 in air, 27 in water)	500 pounds
7 days (1 in air, 6 in water) 1 cement, 3 standard sand	130 pounds
28 days (1 in air, 27 in water) 1 cement, 3 standard sand	220 pounds

If a sample of cement submitted for test shows higher tests than those given above, the average of tests made on subsequent shipments must come up to those found with the sample.

Brands of Portland cement which have been tested in the laboratory of the City Civil Engineer and found to comply with these specifications can be used, provided the following conditions are fulfilled:

First. All cement shall be shipped in strong paper bags or barrels.

Second. With each shipment of cement a certificate of tests made at the mill and the time that the cement has been stored shall be submitted.

Third. Contractors must submit the cement and afford every facility for inspection and testing at least fourteen (14) days before desiring to use it. The Engineer in charge of the testing laboratory shall be notified at once on the receipt of the shipment of cement.

Fourth. Any cement without the stamp of the Engineer in charge of the laboratory, the maker's name, and the brand on the barrel or package, will be rejected without test.

Additional Requirements—Should there be discovered at any time, any characteristics in any cement furnished for the work that would be objectionable in that work, the further use of cement of the same brand on all work of that class will be prohibited regardless of the fact that it has successfully withstood the tests hereinbefore specified.

All cement shall meet such additional requirements as to the "chemical tests" as the City Civil Engineer may determine. The requirements for set may be modified where the conditions are such as as to make it advisable.

Best Proportions of Materials in Concrete.

The following excellent methods of selecting and preparing concrete materials are taken from a pamphlet on the Thacher bars, issued by the Concrete Steel Engineering Company of New York:

Concrete subjected to transverse stress should be composed of high grade Portland cement; clean, sharp, coarse sand, or preferably stone screenings and broken stone or gravel that will pass through a one and a half inch ring. The ingredients must be thoroughly mixed (preferably by machine), and be sufficiently wet for the water to come to the surface with moderate ramming, and it is safer to have the mixture too wet than too dry. No more sand should be used than is necessary to fill the voids. Probably the best results would be obtained by using sufficient sand to fill the voids where rods are embedded, and a minimum of sand or a porous concrete at other points. Experiments have shown that the transverse strength of concrete varies very nearly as the strength of the mortar in which the coarse ingredients are embedded. Two series of interesting experiments were made by Mr. Darnton Hutton at Amsterdam in 1872-78. The test pieces contained various proportions of Portland cement, sand and gravel, the gravel being nearly free from sand. The following results were obtained:

First series, age three months. A mixture of (1:4:5) being assumed as 100, (1:3:6) is 121, (1:2:7) is 225, (1:1:8) is 285, (1:0:9) is 334.

Second series, age four and a half months. A mixture of (1:4:5) being assumed as 100, (1:3:5) is 113, (1:2:5) is 184, (1:1:5) is 289, (1:0:5) is 361.

If concrete is required to be water-proof,

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a wet mixture should be used with mortar more than sufficient to fill the voids.

John Newman recommends for waterproof concrete, a mixture of (1:2:4) when exposed to moderate pressure, and a mixture of (1:1½:3) for exposed work in deep water, or under high pressure. He found the latter impervious under pressure of thirty pounds per square inch.

Newman found that broken brick, however hard, would disintegrate in sea water, and should not be used; he advises the use of sand and gravel from the locality, that has already been subject to the chemical action of the water, if they can be obtained; otherwise hard, durable, broken stone should be used. Dr. Michaelis states that for work in sea water a mixture of coarse and fine sand should be used, of which at least one-third should be very fine, and that cement rich in silica and as poor as possible in alumina and ferric oxide should be used. A small aggregate gives a weaker concrete than a large one with the same amount of cement.

G. L. Sutcliffe recommends the following sizes for aggregates: For walls and floors less than seven inches thick, one-fifth thickness; for walls and floors from seven inches to eighteen inches thick, one-sixth thickness; for foundations, retaining walls, etc., three inches.

Mr. Sutcliffe gives the following empirical formula for finding approximately the tensile strength of Portland cement mortars when the strength of the cement is known: The ultimate strength of mortar equals the ultimate strength of cement multiplied by the ratio of the volume of cement plus 1 to the volume of sand plus 2.

Impervious Concrete.

Sanford E. Thompson, before the American Society of Civil Engineers, presented the following regarding methods of making concrete impervious to water:

The writer's attention was first called to the possibility of making pure concrete of very thin section impervious to water, by a visit to the filtration works of the East Jersey Water Company at Little Falls, N. J., through the courtesy of the resident engineer, William B. Fuller, M. Am. Soc. C. E. A circular wall of reinforced concrete fifteen inches in thickness four feet, with wall and bottom only three inches thick.

The double-track tunnel between Boston and East Boston, built under the harbor by the Boston Transit Commission, Howard A. Carson, M. Am. Soc. C. E., chief engineer, illustrates the construction under difficult conditions, of concrete which could not be laid as a monolith, but had to be built in sections thirty inches in length. The thickness of the arch and walls is thirty-three inches, and at high water the depth of the roof below the surface of the harbor may be as great as seventy feet. The writer observed, when walking through the tunnel soon after the air pressure was removed, that the only leakage consisted of percolations at the joints between the sections of concrete laid on different days. These emitted a scarcely appreciable volume of water, and were being closed by forcing in neat-cement grout under pressure.

It is generally agreed by engineers, in this country and abroad, who are accustomed to placing concrete which is to withstand the percolation of water, that the essential elements for impermeability are:

An aggregate (including sand) proportioned for great density.

An excess of cement.

A wet mixture carefully placed.

Monolithic construction.

The addition of foreign substances, such as soap and alum, slaked lime, or puzzolana, has for its chief object the introduction of very finely divided matter into the pores of the concrete, and as long as the cohesion of the cement is not injured, it makes very little difference as regards the permeability, whether their action is chemical or mechanical. A mechanical addition may actually increase the strength as well as the impermeability, simply by increasing the density, and, therefore, may replace a portion of the cement, which, as the finest ground material in ordinary concrete, must otherwise fill all the residual voids

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M. Feret, in France, has recently been conducting a series of experiments to determine the effects of mixing, by grinding together, materials of a puzzolanic character with cement, to be used in sea water. Specimens in the air were injured by the introduction of this material, but those exposed to the sea water were improved. By comparison with specimens to which had been added matter of the same fineness as the puzzolana, but inert in character, the action is proved to be, at least in part, a chemical one, and the results not merely due to the greater density obtained by the more perfect filling of the voids.

The relation between porosity and permeability, which has been referred to by Mr. Lesley, is misleading. Although M. Alexandre as quoted by M. Feret, shows that the more porous mortars are sometimes the less permeable, this principle cannot be applied strictly to concrete, because, in a porous concrete, as the term is generally accepted, the voids are apt to be of such size that the capillary action of the water contained in them is insignificant. One of M. Feret's most important deductions has a clear bearing upon this point:

"It must not be understood, however, that the quantity of water which, under a given pressure, traverses a mortar during a given time is necessarily proportional to the total volume of voids in the mortar. It depends especially upon the size of the voids considered separately. Thus it is that if one compares a series of mortars obtained by combining equal weights of the same cement with sands of increasingly large dimensions, it is noted that the permeability may be very slight for the first and considerable for the following, although the real volume of solid material entering into the unit volume of the mortars goes on increasing at the same time with the size of the sand."

Mortars made with fine sand, however, M. Feret states, although less permeable, are apt to be more easily acted upon by sea water. Considering, now, mixed sands M. Alexandre has shown by experiments that these are less permeable than either coarse or fine sifted sand alone.

The mixed sands undoubtedly reduce the size of the voids, and as at the same time they give greater density, they are consequently to be selected in preference to either the coarse or the fine. Extending this principle to the coarser materials of the aggregate in concrete, the conclusion is reached that the selection of materials to produce greatest impermeability coincides with the selection of materials for maximum strength, that is, the proportioning of the aggregate so that the grains of any one size will be sufficient in quantity to fill the voids of the larger sizes.

It is obvious that a mass containing voids or "pockets" such as we invariably see in concrete mixed with an exceedingly small percentage of water, and sometimes also in concrete mixed wet but laid carelessly so that the mortar is allowed to run away from the stones, is more permeable than a mixture which to the eye is dense and compact. In regard to the more minute voids the conclusion is not clear, the advocates of dry-mixed concrete claiming that the surplus water when evaporating leaves voids which reduce the density of the mass. Mr. William B. Fuller, a champion of the wet mixture, has, on the other hand, asserted that in his belief the greater specific gravity of the solids causes them to expel the surplus water. Experiments, in collaboration with Frederick W. Taylor, M. E., which the writer now has under way tend to prove the correctness of Mr. Fuller's theory. Careful measurements of specimens, of both mortar and concrete, made with varying percentages of water, show, after setting, almost identical volumes, and, therefore, nearly equal density. A dry mixture, however, to bring it to this point, requires very violent ramming, harder than can be given in practical work, while the very wet mixtures need to be merely "joggled."

With the latter specimens water varying in amount with the quantity used in the mix, rises at once to the surface, and if the mould is tight and the solid materials are carefully proportioned, it may remain there until it evaporates, or until taken up by the capillary action of the mass.

Cement Block Construction in Pittsburg.

Concrete blocks have about been decided upon for the construction of an apartment house in the Hazelwood district in Pittsburg, Pa. W. S. Haynes of Samuel Black & Co., has been in correspondence with different manufacturers of machines for making blocks, according to local press reports, and contemplates purchasing a machine. It is stated that brickmakers in Pittsburg will find concrete blocks for building purposes quite a competitor. The D. J. Kennedy Co., the Houston Bros.

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Co., Peabody & Co., and another large builders' supply firm are operating machines and are selling all the blocks they can turn out. About $75,000 has thus far been invested in concrete block machines, and these companies state that they will have to increase the capacity of their plants.

Concrete Blocks for Manholes.

Concrete has been used by the constructors of underground electrical work for some time in manholes and subways, this type of construction being ordinarily much less expensive than brick work for the same purpose. In soft or wet earth it is sometimes difficult to keep the excavation open long enough to permit the placing of the concrete and there has been some waste of time and material on this account. The New York Telephone Company's engineers have devised a system of concrete blocks which are even cheaper in place than a solid concrete manhole. The walls are approximately rectangular in plan, with slight curves on the sides and curved corners. The blocks are made in two forms to suit the shape of the manhole and by laying them alternately on opposite beds they break joint. In a recent article for Engineering News Mr. Hugh C. Baker gives the following reasons for the superiority of the block manholes, and the accompanying comparative figures of cost:

The advantages of the block manhole as illustrated over all other forms of construction previously tried are that:

1. No skilled labor is required for any part of the construction.
2. The cost is less than the cost of brick manholes of similar size and shape.
3. There is practically no waste of material.
4. When the excavation is ready, the block manhole can be built and the street filled in and opened for traffic in five hours.
5. Concentration of material and supervision in making the concrete blocks.
6. All manholes are exactly the same again, with practically no waste of material, if concrete is properly made.
9. Can be put together in freezing weather, as the blocks can be made at any time and stored, or made under cover.

A number of these block manholes was recently built by the New York Telephone Company at Rye, N. Y. A large barn located near the freight depot was hired as a place in which to mix the concrete and make the wooden molds. Over one hundred complete sets of the flat tops were made in this barn, and some of them were shipped by rail to Larchmont, Port Chester, New Rochelle and Mt. Vernon. A number of these tops were used on ordinary brick manholes.

The following information is given concerning the cost of block manholes actually constructed:

	Set of 6 top blocks.	Set of 30 wall blocks.
Weight, lbs.....	1,853	9,447
Concrete, cu. ft.....	13	67
*Cost of making blocks	$4.27	$21.00
Cost of I-beams in place	5.40	.....
**Cost of blocks in place	6.00	32.00
Time to put in place, ordinary labor	3 man-hrs.	20 man-hrs.

*Not including cost of molds.
**Not including freight.

The total average cost of complete manhole, without iron cover, was $43.40.

The comparative cost of a brick manhole of similar size and shape, covered with the flat concrete top, as actually built, was as follows:

Brick, 1,450 at $8.25 per M.....	$11.96
Mason	6.00
Labor, 46 man-hours at 15 cts.....	6.90
Cement, 4 bbls. at $1.25.....	5.00
Sand	.75
Supervision, etc.....	2.50
Set of six top blocks in place, and I-beams, in place	11.40
Total	$44.51

The cost of excavation has been left out, as it is practically the same in each case.

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MUNICIPAL PROBLEMS

Municipal Ownership in Chicago—City Administration as a Business—Rubbish Destruction—Frederick, Md., Charter.

Municipal Ownership in Chicago.

The Philadelphia Public Ledger recently gave the following sketch of the difficulties which would result from putting into operation the three propositions relating to the municipal ownership and operation of street railways which have been adopted by heavy majorities in a popular vote.

The first proposition relates to the enabling act passed by the last legislature, known as the Mueller law, which permits the cities of Illinois to own, operate and leases street railways after the act shall have been submitted to the electors of any city and approved by a majority of those voting thereon. The second authorizes the city council upon the acceptance of the Mueller law, to proceed without delay to acquire ownership of the street railways under the powers conferred by the Mueller law, and the third enables the city council, instead of granting any franchises, to proceed at once, under the police power and other existing laws, to license the street railway companies until municipal ownership can be secured, and compel them to give satisfactory service. The franchises of the companies affected by the action of the voters, involving the entire railway service of the city, are now operated under a temporary arrangement with the city.

The adoption of the propositions will probably have no immediate effect. The matter is referred to the city council and the Mayor. Municipal ownership of the lines is out of the question for the present for financial reasons. Mayor Harrison says that the problem of raising a vast sum at this time to purchase the lines must perplex any competent financier. The vote, however, gives the council the power to exact terms from the companies which may benefit the public. Mayor Harrison thinks that if the city can make a bargain by which good service can be obtained, and fair compensation secured to the city in exchange for a limited extension of the franchises, municipal ownership might be realized eventually at a comparatively low price.

If it is possible for Chicago to own and operate its street railway lines, the problems of municipal government will be definitely multiplied, aside from the financial perplexities which will arise from the extension of municipal functions. The addition of 10,000 employes to the city pay-roll, all of them essentially officeholders, can not be contemplated without dismay by those who are aware of the influence wielded by the officeholding element in city elections. Maj. Leonard Darwin, in his recently published work on "Municipal Trade," makes the suggestive remark that when anything like the spoils system exists, "the uncertainty of tenure of municipal employes will increase their temptation to neglect the true interests of their employers, the public, and thus fall under corrupt influences."

Conclusions drawn from experience of British cities in the ownership of street railways lines, that such ventures are highly profitable to the municipality and furnish much cheaper transportation than the American lines, are likely to be misleading.

In a series of communications to the Chicago Record-Herald it was shown that the 2-cent rate for Liverpool is equivalent to a 5-cent rate in Chicago. There are no transfers in Liverpool, as in Chicago, and if the Liverpool rates were applied to Chicago it would cost as much as 50 cents to make a full transfer trip on some of the Chicago routes. In Liverpool the fares are charged by stages of about two miles at 2 cents per stage. It is asserted that "the small pay-roll and the short stages account for the profits of the Liverpool lines." The increase in the so-called net profits of the lines in certain British cities in recent years is attributed by one of the correspondents of the Record-Herald wholly to the substitution of electric for horse or steam power, through a corresponding increase in capital outlay and the doubling of fixed charges. The same writer says that there is an unknown sum in rates and taxes lost to the municipality every year which the official figures do not take into account. One item of the cost of

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operation must be given due consideration: the pay of motormen and conductors. The authority cited avers that the rate of pay in Chicago is more than two and a half times that in Liverpool.

City Administration as a Business.

Prof. R. T. Ely, in the Citizens' Bulletin of Cincinnati, holds that European cities are in advance of those of the United States in their progress toward solution of the great problem of municipal administration. Although there are differences of circumstances between German cities, for example, and American cities, these differences are rather superficial than substantial, and are not so great as the difference between an American city of the day and one of a hundred years ago. Any refusal to learn from abroad, on the ground that it is an infidelity to patriotism to copy the ways of another nation, is foolish. True Americanism, in his opinion, "consists in finding the best in all lands and using it for American purposes, modifying it, transforming it to suit whatever is peculiar in our own land."

The Boston Herald thinks it is not an unreasonable opinion, still less is it a traitorous one. The essential condition without which reform in the government of cities is impossible is that the administration of government shall be regarded as a public matter and not as a party matter. As long as all the resources of a city treasury or a city's patronage are employed primarily for partisan ends and not for the common welfare, permanent economy and efficiency are not to be expected. It requires only a short term of continuance in power of a partisan administration to demoralize it. For one term a new party in power may do well. Five terms, and often two terms, will have a seesaw of parties, without accomplishing any enduring progress toward good government. This for the reason that the evils of partisan politics pervert

large circulation of the desire of the German city of Luckenwalde for a competent mayor. Any persons desiring to be candidates, wherever they might live, were requested to send in their names with a sketch of their lives and experience. The salary was named, and it was pointed out that if at the end of his first term—twelve years—the mayor was not reappointed he would be entitled to a pension equal to the salary. Candidates must have had the equivalent of a college education and a university training in law. What Luckenwalde was in search of was a competent superintendent of its complex public interests. It wanted the most competent man in the German empire who could be obtained for the salary it could pay, and it was willing to relieve him of any temptation to get rich during his term by engaging to pay him for life, whether he was constantly employed or not.

This suggests to the Herald that in Germany there is something like a profession of city magistracy, those devoting their lives to it making adequate preparation by a thorough course of study, and, of course, gaining wisdom and efficiency by experience. It would not be thought unreasonable for an American business corporation to advertise for an engineer or financial agent. Perhaps an American city might advertise for an engineer or a sanitary expert or a superintendent of schools, or a roadmaker, without attracting special attention; but one could hardly advertise for a qualified Mayor without provoking abundant satirical comment. Yet most of our cities for most of the time have Mayors who have never learned the rudiments of efficient administration and never served long enough to acquire the knowledge and practice that would make them experts. They go blundering through their terms, the dupes of their underlings in large degree, and count themselves fortunate if they are able to conceal their ignorance so that no public scandal results. If they manage to keep the hun-

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are discussed at much length. The reader who desires the whole argument must be referred to the article itself. A very interesting part of it relates to the frequent failure of the business man as mayor, and the consequent disappointment of those who expected him to do better than a politician. Briefly, it is because the man trained in private business discovers an incapacity to view affairs from the standpoint of the public. "The sentiments, the feelings, the way of looking at things required in municipal administration, which is a public affair, are different from those which must necessarily prevail in private business." In this respect the professional politician often has an advantage. Although he may be inferior in character and intellectual power, he has been trained to look at affairs in their public aspect.

Not the least interesting passage is one relating to his own experience. "At present," he says, " I hold a humble office. I am one of the three supervisors of the town of Madison, Dane County, State of Wisconsin, and it seems to me, after having held the office some six months, that a man ought to hold it for several years to acquire the knowledge and experience needed to make a good supervisor. I have been hammering away at economic problems for twenty years, at least; but in the discharge of my duties as supervisor I feel oppressed by my ignorance. And I presume what I especially lack is sufficient general engineering knowledge; but I see clearly that the engineer requires economics for such an office as truly as the economist requires engineering knowledge."

New York Rubbish Destruction Plant in Operation.

The new municipal plant for disposing of light rubbish and paper wastes was officially opened recently by Mayor McClellan at New York City. A report by Commissioner Woodbury stated that the paper wastes, boots, shoes, tin cans and metals are separated and the residue that is unsalable destroyed by incineration. Each yard of the material that goes into the furnace produces seven horse-power. The plant has the power of producing 200 horse-power per hour, and each one of these horse-powers will produce 1¼ arc lights of 2,000 candle power. One arc light is equal to 12 incandescent lights, which means 250 arc lights or 3,000 incandescent lights. The city pays $146 per year for each arc light. Thus, 250 arc lights at $146 equals $36,500. It cost 30 cents per cubic yard to tow this rubbish to sea and throw it overboard. The city is now disposing of 136,000 cubic yards a year at the municipal plant, and it is estimated that this is done at a saving of $21,000.

A tabulation of earnings shows the following:

We save then by not sending to sea	$21,000
We can earn in lights	36,500
We get from the contractor	10,400
Making an annual income to the city over the previous system of sending to sea of	67,900
Less $1,000 for maintenance of plant	1,000
Or	$66,900

The cost of constructing the plant was $28,900. By working the plant continuously the $66,900 would be doubled, making $135,800, less $2,000 for maintenance of plant, or $133,800 per year. Commissioner Woodbury concluded with the statement that "the combustion of these paper and rubbish wastes is so perfect that there is no smoke, and as no garbage whatever is burned there is no odor."

Provisions of New Charter of Frederick, Md.

A new charter has been granted the city of Frederick, Md., which gives the City Register power of distress or execution for taxes. The Mayor has, heretofore, had absolute power of appointment of police, collector of water rents, superintendent of water works, etc., but now his appointments are to be made subject to the confirmation of the aldermen by a majority vote. Other provisions of the charter are as follows: Charges for water rents shall be liens on the real estate on which the water is used; the Mayor and aldermen shall not expend in any one year for regrading, recurbing and sewering with material other than cobblestone more than the amount received during that year for licenses; the Mayor and Aldermen may, by ordinance, provide for a revaluation of all the real and personal property in Frederick for the purpose of municipal taxation; they are given the power to regulate and provide for the issuing of licenses or permits for all hawking, peddling and vending of marketable commodities, wares and merchandise of every description upon the streets and highways of the city, and to issue licenses or permits to all itinerant peddlers who may go from house to house to vend or sell any wares or merchandise; to regulate and provide

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for the issuing of licenses to all traveling persons who dispense medicine or medical advice and secret or patent inventions or remedies, and for licensing commercial travelers and all retail dealers and solicitors non-residents of the city; to regulate and license hackney carriages, omnibuses or other vehicles used in the city for the carriage of passengers or travelers; and if they see fit they may require every such vehicle to be numbered to correspond with the number upon the license issued to it in pursuance of this authority; to levy or collect a license or tax upon all vehicles of every kind owned by residents of the city and habitually kept therein and used upon the streets thereof; and the mayor and aldermen shall also have the power by ordinance or ordinances to levy and collect a license tax upon and regulate any and all callings, trades, professions and occupations conducted, pursued, carried on or operated within the limits of said city, and may levy and collect special taxes upon all telegraph, telephone, electric light or trolley poles or posts erected and maintained within the corporate limits of Frederick.

SEWAGE DISPOSAL

Farington, Eng., Sewage Disposal Works.

By William Naylor.

In most cases where the available fall for filters has been, as in this case, limited to 3 feet, either pumping has been resorted to or a large area of land requisitioned, upon which the heavily burdened first-contact or even continuously sprinkled effluent, has been distributed, with a view to the inducement of nitrification; indeed, the practically complete nitrification of septic tank effluents on filters 3 feet deep has not yet been reported as in operation, to the author's knowledge, the Scott-Moncrieff trays, perhaps, excepted.

At Farington a special method of slow, intermittent, and "rained-on" feed has been evolved, which has proved itself capable of producing an effluent well charged with nitrates, and in which the disappearance of dissolved oxygen after saturation with air is as slow, and as little in total amount, as need be aimed at. The "albuminoid ammonia" and "oxygen absorbed" figures also fall well within all published standards.

The incoming sewage gravitates to the junction manhole from two opposite directions, the 12-inch and 15-inch sewers serving two separated portions of the township between which the works are sit-

is 78.00, septic tanks altogether above ground level, and so capable of discharging fairly solid sludge after the withdrawal of the supernatant liquor, were out of the question. Artificial filters of some description were necessary, also, owing to the small area of land available. The septic or "preparation" tanks were therefore made about 12 feet deep and provided with a syphonic sludge removal apparatus, which is put into operation as often as any considerable quantity of solid particles is seen passing towards the filters—at least once a week.

The tanks have now been in operation about two years, and although preceded by fairly large detritus tanks it is very plain that to use them continually without the frequent abstraction of sludge would simply lead to disaster. The tank effluent is, notwithstanding, quite putrid and ready for bacterial filters as it enters the measuring chamber. Sludge from the syphons is discharged into chambers whence it gravitates into drainers and the liquor therefrom is pumped at a well back into the septic tanks.

The filters, seven in number, are exactly 3 feet deep, with 9-inch brick sides and 9-inch concrete floors. It was intended at the outset that these should be used as "Dibdin" contact beds; it was also anticipated that the area provided—about 450 square yards—would be sufficiently

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lons. These anticipations, however, were not realized, for a first-contact effluent liberating less than 0.2 albuminoid ammonia was not obtained under any practicable variation of contact time or preliminary sewage preparation, and to make matters worse the irrigation areas treated with such effluent as was obtained soon exhibited signs of permeated putridity of sewage "sickness."

After four or five months' trial the idea of single-contact was given up and revolving distributors were installed with Ridgeway's arrangement for putting valves into operation in rotation and so discharging the contents of the measuring chamber, capacity 2,500 gallons, over each of the filters in turn. But the low hydrostatic head to the distributor called for a great volume to put it into motion—a volume so great that the feed was just a flush through the filter, and the filter effluent as bad as before, black and void of nitrates.

As a slower rate of feed during the actual revolutionary period of the distributor was impossible with the given head, a shorter period of feed was resorted to by putting the whole of the distributors into operation at once, thus apportioning to each filter, say 350 gallons. To effect this purpose all the feed valves in the chamber were connected with each other as well as to a central shaft, as an alternative to building seven separate measuring chambers, the most suitable capacity of which had not yet been really ascertained. The 350 gallon discharge was then found to be largely in excess of the filter capacity, and that quite independently of the period of time intervening between the discharges; indeed, judged on the trials at this point it appeared as though the filters were about to exhibit no efficiency at all.

So far as could be observed, the only remedy short of perforated pipes for distributing arms (and the open trough arms were already installed) was to cut down the discharge period. The 350 gallon discharge involved about eight revolutions of the distributor and an intervening period of about half an hour between each discharge.

A series of experiments was then carried out with the idea of getting at the particular volume of discharge, sufficiently small to be void of flushing effect, that is to be retained by the filter and subject to bacterial action. Naturally, for each particular filter this volume will be governed by the texture of the filter; indeed, the volume may be said to be directly proportional to the fineness of the filtering material so long as choking is provided against by the interception of suspended particles.

It was discovered, by controlling the inlet valves by hand for some time and examining the effluents produced, that the most favorable volume of discharge for this hydrostatic head, and the texture of filter (1-in. to 1½-in. clinker) was 130 to 140 gallons per filter, involving three revolutions of the distributor, ten minutes normal interval between the discharges, and a fall of 4½ in. in the water line of the measuring chamber.

The fulfillment of these conditions was then secured automatically by an arrangement for closing the inlet valves to the distributor after a fall of 4½ in. in the water line, in preference to blocking up the measuring chamber space so as to reduce the capacity to seven times 130 gallons. The advantage of the capacious measuring chamber is undoubted. All septic tank effluents contain a certain amount of sparingly soluble disintegrated matter, which falls into suspension on coming into contact with air for a short time. The measuring chamber receives this as a deposit even from a tank effluent which enters it quite clear, and so reduces the quantity of humus always present in a good filtrate from a continuously sprinkled bacterial filter.

It is apparent that the success of the filters is not due entirely to the fact that the actual feed per cubic yard per twenty-four hours is about the same as that of a 9-ft. filter used continuously. As a matter of fact an excellent effluent is produced with only five-minute intervals between the discharges, equivalent to 300,000 gallons per twenty-four hours, or 600 gallons per cubic yard, though this rate of feed has never run over two hours—twenty-five discharges, 25,000 gallons.

Each discharge of three revolutions represents a film less than ½ in. thick, and the delivery from the filters varies but little, unless the interval between the discharges is extended by virtue of reduced sewage inflow to about fifteen or twenty minutes. Evidently much depends upon the sponge-like retentivity of the filter, and in the case of shallow filters it is certain that success depends upon the adjustment of feed with relation to the mechanical retentivity of the filter, a matter in which the hydrostatic head plays an imporant part in the case of open trough distributors.

Perforated pipe distributors might meet the difficulty, but for filters of close texture, such as shallow filters can only be,

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Farington, Eng., S
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By William

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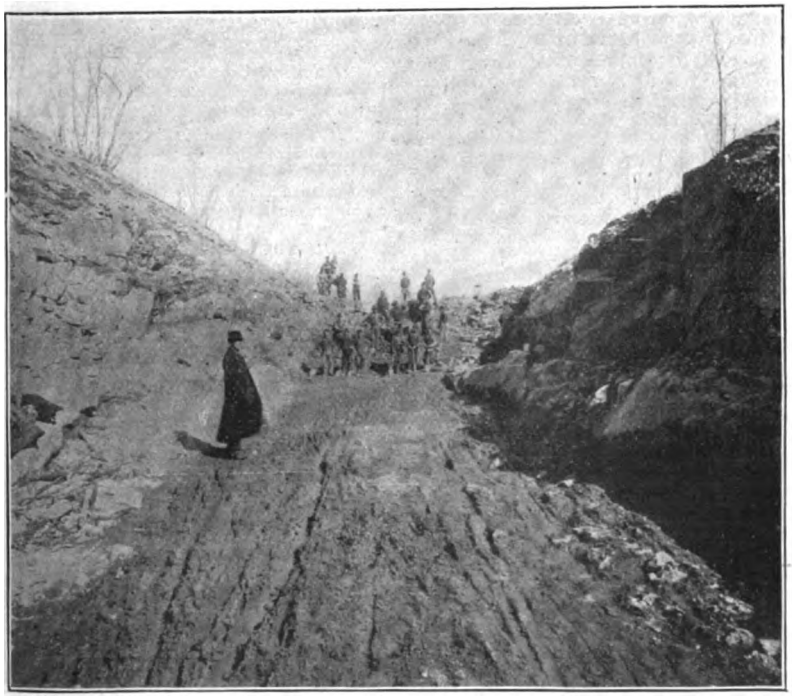
NEW JERSEY PUBLIC ROADS.
Newton turnpike before improvement.



NEW JERSEY PUBLIC ROADS.
Newton turnpike during improvement.

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intermittent sprinkling must be resorted to, whatever class of sprinklers are used, and the above described arrangement produces an effluent which should satisfy the most fastidious. Any credit due on account of the mechanical difficulties overcome must be accorded to Messrs. Mather & Platt, who stuck manfully to the business long after their contract obligations were fulfilled, and when the black, foul filtrate offered little encouragement.

The filtrate from the beds flows, by means of drains, to the specially reserved irrigation area beyond the embankment.—The Surveyor.

PAVING

Coal Right Not Assessed—Specifications for Asphalt Pavements.

Assessment of Coal Right Under Street for Its Pavement Is Refused.

An opinion was rendered April 9, at Springfield, Ill., by Judge Murray, of the County Court, on the assessment on the coal right underlying the ground of S. Sixth-st., from Pine to Oak-sts. The property owners presented a petition to the board of local improvements asking that the street be paved with brick on six-inch concrete foundation, with stone curbing. Judge Murray's opinion is as follows:

First—It is objected that the coal right, which it is understood is several hundred feet below the surface, is not assessed for the pavement. It is claimed that the owner of the fee is not the exclusive owner of the lot, and, therefore, the lot as it appears on the surface is not the only part which should be assessed.

The court does not think that this objection is well taken. The right or privilege to remove the coal from the premises hundreds of feet below the surface is sought to be assessed by the objection filed herein. No similar question (so far as this court knows) has ever been raised, and it must be, therefore, disposed of without any former adjudication of the same question.

Cities and villages are authorized by the constitution and laws of the State to make public improvements by special assessment, or by special taxation of contiguous property, and in no case can any property be assessed beyond the benefits derived from the improvements to be made.

Is it any benefit to the coal right to pave the street which adjoins the lot under the surface of which this coal right exists, the coal being removed and brought to the surface quite a distance from the improved street?

Without further discussion at this time of the question as presented, the court overruled the objection.

Specifications for Asphalt Pavements.

The specifications for the bituminous portion of asphalt pavements most recently adopted by the engineer department of the District of Columbia are as follows:

The binder course shall be composed of clean, broken stone, equal in quality to the stone for the base, and passing an inch and a quarter screen. Eighty-five per cent of this shall pass said screen in its longest dimensions, and of the remaining fifteen per cent no piece shall have a larger dimension than 2 inches, and the stone, after passing the heating drums, shall not contain less than five nor more than fifteen per cent of material passing a No. 10 screen.

The stone will be heated not higher than 350 degrees Fahrenheit, in suitable appliances. It is then to be thoroughly mixed by machinery with asphalt cement, such as is acceptable for surface cement, penetration 60 to 90, at such temperature and in such proportions that the resulting binder will have life and gloss without an excess of cement. Should it appear dull from overheating or lack of cement, it will be rejected. While hot it will be hauled upon the work, spread upon the base so that when compacted it will be at least one and one-half inches in thickness, and immediately rammed and rolled until it is cold. Should the resulting course not show a proper bond, it shall be immediately removed and replaced by the contractor.

The contractor shall not enter upon a concrete base in order to lay the binder course until it has obtained sufficient strength for such a purpose, and during the period between laying the base and binder he shall properly protect it, and.

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NEW JERSEY PUBLIC ROADS.
Newton turnpike before improvement.

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when ordered by the Engineer Commissioner, shall sprinkle it in warm weather between the hours of sunset and sunrise as often as may be deemed necessary, and in cold weather cover it with a material suitable for protection.

Asphalt Wearing Surface—The wearing surface of the pavement shall be composed of asphaltic cement, clean, sharp-grained sand and fine absorbent mineral dust.

The asphaltic cement must be practically free from water, and must be within the range of 40 and 70 penetration when tested at 77 degrees F. The amount of penetration to be fixed by the Engineer Commissioner.

Preference will be given to an asphaltic cement that is not readily affected by the action of water, provided it is satisfactory in other respects. If an asphaltic cement is accepted that is affected by water some provision satisfactory to the Engineer Commissioner must be made to guard against the results of such action, and such work must be included in the price bid.

The bitumen of the asphaltic cement must comply with the following tests:

1. It must be of such a consistency that when tested at 32 degrees F. it will not show hardness below 10 penetration, and when tested at 115 degrees F. it will not be softer than 350 penetration.

2. When a prism of the bitumen 1 centimeter square and 5 centimeters long is tested for ductility at 77 degrees F, it must draw out to a distance of 20 centimeters before breaking.

3. When the bitumen is heated in an open tin at a temperature of 300 degrees F. for eighteen hours in a hot-air oven it must not show a loss by volatilization of over 5 per cent and it must not have been hardened over 50 per cent by this heating.

The asphaltic cement must never be heated to a temperature that will injure it.

When the asphaltic cement contains over 5 per cent of material that will separate by subsidence while in a molten condition it must be thoroughly agitated before drawing from storage and while in use in the supply kettles so as to insure a uniform cement.

These tests shall be made by uniform methods, descriptions of which are on file in the office of the Engineer Commissioner.

Sand—The sand in use shall be hard grained and moderately sharp. On sifting it should have at least 15 per cent of material that would be caught on a 40-mesh

ished on streets of light traffic when approved by the Engineer Commissioner.

Mineral Dust—This shall be any fine, absorbent, inorganic dust not acted upon by water, the whole of which shall pass a 30-mesh screen, and at least 75 per cent pass a 100-mesh screen.

Asphalt Paving Mixture—The materials complying with the above specifications shall be mixed in proportion by weight, depending upon their character, and the traffic on the street, and upon the character of the asphalt, and will be determined by the Engineer Commissioner, but the percentage of bitumen in any mixture soluble in carbon bisulphide shall not exceed the limits, 9 to 13 per cent. If the proportions of the mixture are varied in any manner from those specified the mixture will be condemned; its use will not be permitted; and, if already placed on the streets, it will be removed and replaced by proper materials at the expense of the contractor.

The sand, or the mixture of sand and stone dust, and the asphalt cement, will be heated separately to about 300 degrees Fahrenheit. The dust, if limestone, will be mixed while cold with the hot sand in the required proportions and then mixed with the asphaltic cement at the required temperature, and in the proper proportion in a suitable apparatus, so as to effect a thoroughly homogeneous mixture. Sand boxes and asphalt gages will be weighed in the presence of inspectors as often as may be desired.

Samples of all material entering into the composition of the pavement shall be supplied to the Inspector of Asphalt and Cements when required, in suitable tin boxes and cans, and he shall have access to all branches of the works at any time.

The pavement mixture prepared in a manner thus indicated will be brought to the ground in carts at a temperature of not less than 250 degrees or more than 350 degrees Fahrenheit, and if the temperature of the air is less than 60 degrees Fahrenheit, the contractor must provide canvass covers for use in transit. It will then be thoroughly spread to a thickness of at least two and one-half (2½) inches by means of hot iron rakes, in such manner as to give uniform and regular grade, so that, after having received its ultimate compression, it will have a net thickness of at least one and one-half (1½) inches. This depth will be constantly tested by means of gauges furnished by the Engineer Commissioner. The surface will then be compressed by hand-rollers, after which a small amount of hydraulic cement will be swept over it, and it will then be thoroughly compressed by a steam-roller

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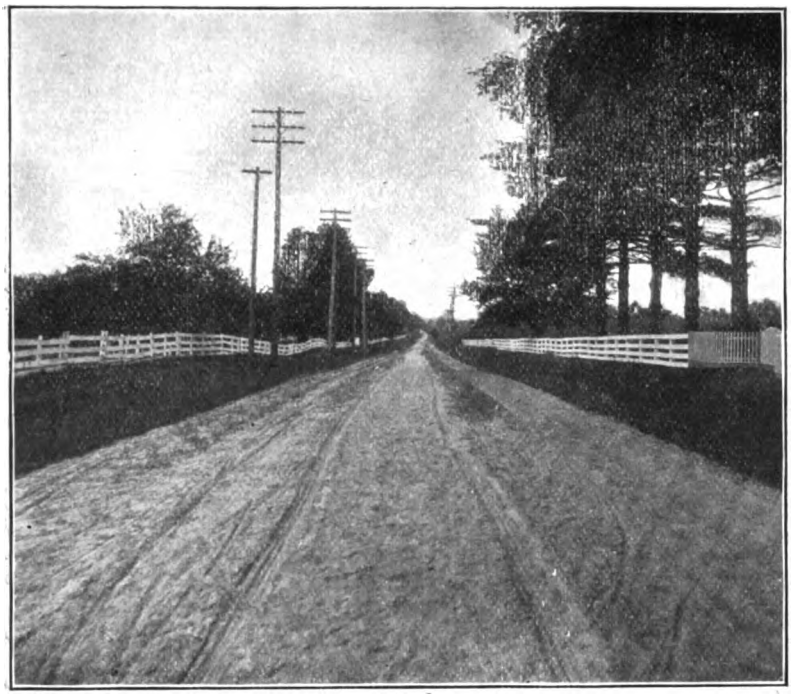
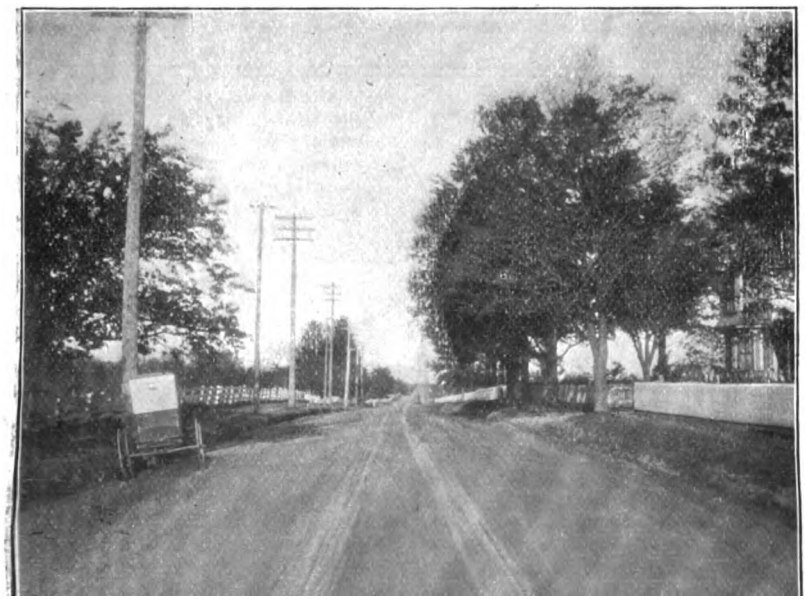


NEW JERSEY PUBLIC ROADS.
Cranbury and Pleasant Hill road before improvement.



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ring, well rammed, and rolled with a steam-roller weighing not less than five tons. The rolling will be continued until the stone ceases to creep before the roller, and until it is evident that the final compression has been reached. It will then be thoroughly coated with asphaltic paving cement or coal tar of approved quality, as directed.

—Resurfacing Over Asphalt and Coal-Tar Pavements—

The above specifications shall also apply, as far as practicable, to all work of resurfacing. When the binder coat cannot be made of uniform thickness, it will be paid for by the cubic foot, measured in carts. The Engineer Commissioner will decide which method of payment will be adopted in each case.

—Ordinary Repairs—

The work to be done under this head includes the repairing of all asphalt and coal-tar pavements where defective, due to wear or accident, the repairs of all cuts such as those made for tapping sewers, water pipes, etc., and generally all patching and miscellaneous work necessary to keep the pavements in good condition for travel during the contract period. The pavement must be repaired with materials as described above.

The repairs shall be made at such times and place, and in such manner as may be described, and when deemed necessary on certain streets, between the hours of 8 p. m. and 8 a. m. All old material shall be cut out and removed at the contractor's expense, and in the case of undercuts and overhanging portions shall be removed.

Except in special cases the base of the pavement over any cuts will be laid by the District, and the surface only by the contractor. The Engineer Commissioner may, however, call upon the contractor to lay the base wherever he may deem it advisable.

The holes cut out shall be cleaned and the edges painted with hot paving cement, of such quality as may be acceptable to the Engineer Commissioner.

Barricades of a suitable form to prevent traffic over recently-laid work shall be provided and kept in place until the surface has hardened sufficiently to withstand pressure. These barricades and their use must be subject to the approval of the Engineer Commissioner.

POWER TRANSMISSION

Chains and Chain Transmission.*

By Charles H. Hills, Indianapolis.

The application of chains to power transmission is not new; chains having been in use for more than a century, in one form or another, but the advantages of their application have not been recognized by the engineer until within the last few years. This lack of recognition can no doubt be traced to the lack of information concerning their action, and for that matter very little reliable information is to be had today upon the subject.

Chains are applicable wherever a positive speed ratio is to be secured, wherever the elements would prove destructive to belting or rope, wherever there are short on account of their low first cost, but the systematic development of the machine-made chain has placed it in the lead for the better class of work. A machine-made chain, when properly designed and constructed, is superior to a cast one, in accuracy of pitch, greater strength per unit of weight, greater and better bearing surface, longer life, more efficiency and possibility of a higher chain speed. While the machine-made chains are many, I will only briefly describe those known as the "block" and the "roller," with a brief mention of a form that is coming into general use, known under the head of "cable" or balancing chains.

Figure 1 shows a block chain. This chain is very simple, consisting of three

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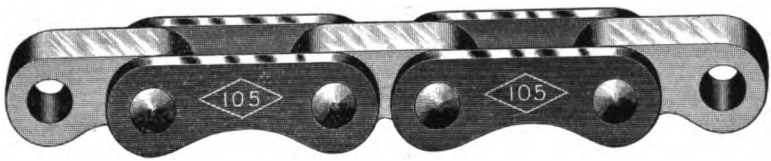
ate speeds—600 feet a mniute and under—being extensively used on bicycles, motor cars, milling machines, drill presses, etc.

Figure 2 represents a roller chain. The construction of this chain is more complex than that of the block, but it is lighter for the same tensile strength, has a better action with the sprocket, is more efficient and permits of a higher



1. BLOCK CHAIN.

chain speed. It consists of five parts, namely: The outer or rivet side bar, the inner or bushing side bar, rivet, bushing and roller. The object of the bushing is to increase the wearing surface of the rivet. If the bushing were omitted and the roller placed on the rivet, the bearing would be reduced to the thickness of the inside side bars, while with it the bearing surface extends the width of the chain. It will be noticed that the bushing is flattened on one side. This is to insure against its turning in the

2. ROLLER CHAIN.

side bar as the chain is bent around the sprocket. It has been found by experience that nickel steel should be used for the rivet to give best results. This with the bushing and roller is hardened, to reduce the wear and increase the life of the chain. Another very important point to be considered in the construction of this chain is the thickness of the rivet side-bar. The rivet acts as a beam loaded uniformly. With a thin side-bar it approaches the condition of being supported at the ends, while a thick side-bar makes it aproach more nearly the condition of being fixed at the ends. Besides increasing the strength of the chain, a thick rivet side-bar is superior to a thin one, inasmuch as it makes the rivet less liable to work itself loose. Experience seems to show that the thickness of the rivet side-bar should be approximately one-half the diameter on the rivet head.

This type has been the outgrowth from the demand for a chain that combines good mechanical construction with high efficiency It is used today almost exclusively on motor cars, and is coming into general use for such work as driving engine governors, mechanical stokers, machine tools, woodworking machinery and the better class of conveyors.

One of the chief problems that has confronted the chain manufacturer has been the production of a chain that will not lengthen its pitch by wear at the joints. By using high-grade steel and hardening all of the wearing surfaces, much has been done to reduce this to a minimum.

It is to be regretted that the design and manufacture of sprockets have not in general received the same careful attention that has been given the chain. It is the popular notion that a good chain will run on almost any sprocket, no matter what its design. This is not the case and ought to be self-evident, yet today the demand

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is for small sprockets cut in such manner as to give low first cost with no regard for the action of the chain. The fact of the case is, however, that the sprocket plays a part quite as important as the chain and ought to receive the same care in its design and construction

Much might be said on the design and construction of sprockets, but I will not take time to enter deeply into the discussion here, but rather call your attention to a few of the more important points that should be closely observed.

No sprocket should be used that has less than twelve teeth, unless the chain speed is very slow, and then the life and efficiency of the chain is impaired by so doing. The sprocket should be cut with a clearance along the pitch line equal to about one-tenth the pitch of the chain, and the face of the tooth so shaped that the blow due to the engagement of the tooth with the chain, shall be reduced to a minimum.

A chain and sprocket to give good satisfaction must be cleaned, and properly lubricated at regular intervals. A satisfactory lubricant for this class of work is a good grade of oil mixed with graphite in equal proportions.

There is one other type of chain to which I wish to call your attention, because it directly interests every branch of the engineering profession. This is a simple leaf chain, known as a cable or balancing chain. As the name implies, it is used for holding counter weights and numerous other similar duties.

In conclusion the writer wishes to thank the Federal Manufacturing Company, Diamond Chain Factory, for the cuts used in the above article.

Guesswork Estimates in Engineering Costs.

A gentleman of great experience in manufacturing recently told the writer that he believed accurate cost keeping was very much less common than was ordinarily supposed, and that he had had opportunities in competitive bidding in which his firm took part, and where they knew from experience the absolute cost of the work, to observe that competitors were taking work materially below cost; in some cases it actually led to the failure of the firms who had made the mistake. There is a great tendency in many places where the work done consists of building rather large machines of varying sizes instead of repetition work on smaller things, to submit proposals necessarily based on estimates. Unless there is a carful system of costs, the estimates in many cases are mere guesses.

Instances are common where estimates are based simply on a price per pound of machinery, predicating these figures on prices for which other contracts had been taken on machinery whose weight was known. This is the very roughest kind of work, and it should never be done if it can be avoided. The reason probably for not having accurate costs is that it is expensive to establish an accurate cost system; but it is easy to see that when business is carried on without an accurate knowledge of real costs it is quite possible for a single error in estimating to involve a loss greater than the expense of a proper cost system for a great many years.—W. M. McFarland, in Cassier's Magazine

MUNICIPAL AND TECHNICAL LITERATURE

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The Directory of American Cement Industries. Third Edition, revised and enlarged. Edited by Charles Carroll Brown, M. Am. Soc. C. E., 740 pp. $5. Municipal Engineering Company, Indianapolis and New York.

This new edition of the standard representation of the cement trade is now all off the press and will be issued from the bindery in a very few days after the publication of this number of Municipal Engineering. The separation of the Handbook to be issued separately as the "Handbook for Cement Users" at $3, removed 250 pages in the second edition and these have been filled with new names in the various lists, thus increasing the number of names included in the book to more than 40,000.

These lists include the manufacturers of cement, companies and their officers, the sales agents, the dealers in lime, cement, and plaster, contractors and other users of cement, engineers, architects, and other supervisors of the use of cement, laboratories and engineers making analyses and tests of cement and cement materials, engineers designing and constructing cement plants, the manufacturers of and dealers in machinery used in cement plants and by workers in cement, manufacturers of lime and plaster. There are also special lists of makers of cement blocks and artificial stone and brick with lime and cement, and of makers of machinery and molds for this class of work.

The descriptions of the plants at which cement is manufactured have been thoroughly revised and the many new plants put in operation since the last edition have been added, making this section as complete and full as the plan of the book requires. There is a full alphabetical list of the brands of American cements of all kinds on the market, with due reference to the descriptions of works at which they are made. The foreign list of manufacturers and brands has also been thoroughly revised and enlarged and is now quite complete for the countries prominent in the manufacture of cement.

The new edition is thus more complete and full than any preceding edition and truly represents the vast increase in the cement trade which has been made during the past two years.

As this number goes to press the binder reports that he will begin delivering books on May 9. As the advance sale has been very large it will take several days to fill all orders. They will be filled in the order in which they were received.

ORGANIZATIONS AND INDIVIDUALS

Technical Meetings—Personal Notes.

Technical Meetings.

A State Good Roads convention will be held at Springfield, Ill., May 3 and 4.

The tenth annual meeting of the National Municipal League and the eleventh national conference for good city government was held at Chicago beginning April 27. The program embraced the following: "Home Rule Provisions in American Municipal Charters," Dr. Ellis P. Oberholtzer, Philadelphia; "Municipal Taxation," Lawson Purdy, New York; "Municipal Ownership," Prof. James Mayor, Toronto, Ont.; "Partnership in Municipal Government," Charles J. Bonaparte, Baltimore.

The semi-annual meeting of the Ohio Society of Chemical, Electrical and Steam Engineers will be held at Columbus, O., May 13 and 14.

The Engineers' Club, Columbus, O., held a meeting April 16. E. A. Kemmler, assistant city engineer, read a paper on "Sewer Construction," in which he gave a brief outline of the elements of sewer design and construction, and a description of the work accomplished in Columbus during the last two years. He de-

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scribed details of special work, such as flush tanks, automatic intercepters and inverted siphons.

The first annual meeting of the Illinois State Good Roads Association will be held at Springfield, May 3 and 4. Among the addresses to be delivered are the following: "Good Roads from the Standpoint of the Farmer," Congressman B. F. Caldwell; "National Aid," Senator A. C. Latimer of South Carolina; "State Aid," Hon. Martin Dodge, roads inquiry department, Washington, D. C.; "Good Roads from the Standpoint of the Laboring Man," F. J. Shiffington, Boston, Mass.; "Good Roads from the Standpoint of the University Man," Alfred Bayliss, State Superintendent of Instruction; "Economics of Good Roads," Prof. Ira O. Baker, University of Illinois.

The twenty-seventh convention of the National Electric Light Association will be held in Boston, Mass., May 24 to 27.

The eighth annual convention of the League of American Municipalities will be held in East St. Louis, Ill., Oct. 4, to Mich.

The Permanent International Association of Navigation Congresses, the office of whose secretary is at 88 Rue de Louvain, Brussels, Belgium, is made up of official representatives from various governments and of individuals. A circular giving the membership and the constitution and purposes of the society is sent out by the American representatives, of which Col. C. W. Raymond, 39 Whitehall-st., New York City, is the head, and anyone not receiving a copy can obtain one by writing to any of the American representatives or to the secretary.

The National and International Good Roads convention will be held in St. Louis May 16 to 21, 1904.

The Kentucky Water Association will hold a meeting in the Galt House, Louisville, Ky., on May 3. More than half the water companies and departments in the State have signified their intention to send representatives. W. A. Patton, Catlettsburg, is the secretary.

Personal Notes.

C. T. Wilson has been reappointed city engineer at Waterloo, Ia.

J. F. Langan has been re-elected city engineer at Pittston, Pa.

H. F. Robinson has been appointed city engineer at Phoenix, Ariz.

J. E. Carroll has been re-elected city engineer at Crookston, Minn.

E. A. Kingsley has been elected superintendent of public works at Little Rock, Ark.

William H. Bowne has been appointed village engineer at Glen Cove (L. I.), N. Y.

W. B. Ropes has been appointed city clerk at Mount Vernon, Wash., by Mayor Laughlin.

Francis A. Price has resigned as engineer to the department of sewers at Wilmington, Del.

Thomas F. McGilvray has succeeded William B. Patton as city engineer at Duluth, Minn.

John R. Hardin has been reappointed park commissioner for a term of five years, at Newark, N. J.

W. T. Daniel has been appointed superintendent of water works at Tuscaloosa, Ala., to succeed W. T. McCormick.

Philip Prioleau has been re-elected city engineer at Jacksonville, Fla., which position he has filled for eight years.

A. A. Fobes has been reappointed engineer of the board of public works at Pittsfield, Mass, which position he has held since 1893.

Arthur Warren has been appointed to take charge of the new Department of Publicity created by the Allis-Chalmers Company.

John Finan, jr., has been appointed city engineer at Connersville, Ind., to succeed Karl Hanson. Mr. Finan was formerly city engineer of Elwood, Ind.

Denison Fairchild of Buffalo, N. Y., has been appointed town engineer of West Seneca, and will prepare plans for a sewerage system and maps for the assessors' use.

T. W. Keele, principal engineer of harbors and rivers of Australia, has been appointed president of the Metropolitan Water and Sewerage Board at Sydney, Australia.

Fritz Worm has been elected president and treasurer of the German-American Portland Cement Works at La Salle, Ill., to succeed George C. Prussing, who resigned the presidency.

Harron, Hopkins & Taylor of Pittsburg have been elected borough engineers of Wilmerding, Pa., succeeding C. A. Stewart, who resigned to become superintendent of public works at North Braddock.

D. H. Sawyer has resigned as city engineer at Paris, Ill., to accept a position as assistant to General Manager L. E. Fischer, of the McKinley Street Railway Syndicate, with headquarters at Danville, Ill.

George P. Wright, the newly elected Mayor of Tacoma, Wash., has appointed

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has been appointed superintendent of the Midland Portland Cement Company at Indianapolis, Ind.

George N. Fernald has been reappointed commissioner of public works for three years, Frederick V. Chase water commisioner for three years, and Elias Thomas, jr., water commissioner to fill unexpired term of D. F. Corser at Portland, Me.

Messrs. Allen Hazen and F. W. Cappelen have been asked to act with Dr. Bracken, secretary of the Minnesota Board of Health, Prof. Bass and Andrew Rinker, city engineer of Minneapolis, to consider the filtration of the water supply of that city.

Louis C. Kelsey, ex-City Engineer of Salt Lake City, Utah, has former a partnership with Charles E. Reed, to be known as Louis C. Kelsey & Co., and established offices at 408-4 D. F. Walker Building, Salt Lake City, for the practice of civil engineering and contracting.

O. S. Kelly, Springfield, O., died April 11, aged 78 years. Mr. Kelly was a carpenter during his early life, but gave up that trade to seek his fortune in California in 1852. He succeeded in this and returned to Springfield and formed a partnership with William N. Whiteley, O. S. Kelly and Jerome Fassler. Later he bought out Rinehart, Ballard & Co., established the Springfield Engine & Thresher Company, the Kelly Road Roller Company and the Kelly Piano Plate Company.

Dr. Ernst J. Lederle, formerly commissioner of public health of New York, and for many years a member of the scientific staff of the health department, has established laboratories at 518 Fifth-ave., New York City, for sanitary, chemical and bacteriological investigations. Associated with Dr. Lederle are R. C. W. Wadsworth and Dr. Joseph A. Deghuee. Special attention will be given to general building sanitation, the supervision of public and private water supplies, drainage and sewage disposal systems, chemical and bacteriological analyses of water, and bacteriological analyses of water, milk, foods and commercial products and clinical investigations for physicians and toxicological examinations.

Mayors have been elected and re-elected during April as follows: J. F. Alman, Jonesville, S. C.; Jacob S. Manners, Flemington, N. J.; Robert T. Smith, Newton, N. J.; Nicholas Harris, re-elected, Belvidere, N. J.; Dr. Frank M. Cook, Hackettstown, N. J.; D. M. Bradham, re-elected, Manning, S. C.; L. M. Olsen, Sleepy Eye, Minn.; J. F. McGovern, Wabasha, Minn.; W. E. Scanlon, Anoka, terman, Crookston, Minn; P. R. Vail, Ely, Minn.; H. M. Angler, Litchfield, Minn.; Frank Werrick, Belle Plain, Minn.; C. H. Robinson, Waterville, Minn.; T. J. McElligott, Madison, Minn.; Frank L. Glotzbach, Faribault, Minn.; Judge William F. Henney, Hartford, Conn.; E. A. Van Sicklin, Weiser, Idaho; T. K. Little, Caldwell, Idaho; Frank Creighton, Payette, Idaho; E. P. Coltman, Idaho Falls, Idaho; D. W. Swinehart, Pocatello, Idaho; Eli McIntire, Rexburg, Idaho; Wilford McWilliams, Montpelier, Idaho; Nick Paull, Bellevue, Idaho; Herman Rossi, Wallace, Idaho; C. C. Brownell, Albion, Mich.; Frank Holmes, Alpena, Mich.; Dr. D. L. Treat, Adrian, Mich.; R. B. Gillette, Benton Harbor, Mich.; R. M. Wilson, Belding, Mich.; D. C. Morrell, Big Rapids, Mich.; James Johnson, Cadillac, Mich.; Elisha Shepherd, Charlotte, Mich.; A. J. Lacey, Clare, Mich.; Clarence Merwin, Dowagiac, Mich.; J. W. Sheldon, Eaton Rapids, Mich.; Bruce MacDonald, Flint, Mich.; Edwin F. Sweet, Grand Rapids, Mich.; H. S. Harbeck, Grand Haven, Mich.; J. E. Osmun, Greenville, Mich.; Edward Frensdorf, Hudson, Mich.; Thomas Coughlin, Hancock, Mich.; Henry Geirlings, Holland, Mich.; Fred Heath, Hastings, Mich.; F. C. Miller, Ionia, Mich.; W. W. Todd, Jackson, Mich.; J. W. Osborn, Kalamazoo, Mich.; Dr. Blake, Lapeer, Mich.; F. W. Graham, Ludington, Mich.; Hugh Lyons, Lansing, Mich.; Edward Duel, Mt. Pleasant, Mich.; Dr. Victor Sisung, Monroe, Mich.; Dr. W. W. Root, Mason, Mich.; G. H. Haggerson, Menominee, Mich.; James C. Beckwith, Marshall, Mich.; George Rockwell, Midland, Mich.; William Wente, Manistee, Mich.; W. Greene, Marquette, Mich.; Leonard Eycke, Muskegon, Mich.; John Westendorf, Mt. Clemens, Mich.; L. H. Beeson, Niles, Mich.; Dr. Hudson, Negaunee, Mich.; Stanley E. Parkhill, Owosso, Mich.; R. M. Winston, Petoskey, Mich.; Dr. John D. Riker, Pontiac, Mich.; F. A. Miller, Stanton, Mich.; H. G. Wiley, South Haven, Mich.; George S. Aldrich, St. Louis, Mich.; Simon Langell, St. Clair, Mich.; Ananias Pouch, St. Johns, Mich.; N. C. Rice, St. Joseph, Mich.; E. J. Fulghum, Traverse City, Mich.; C. J. Barnett, West Bay City, Mich.; E. R. Nellies, Wyandotte, Mich.; George M. Gaudy, Ypsilanti, Mich.; W. F. Gallagher, Corunna, Mich.; A. L. Wall, Fargo, N. D.; George E. Duis, Grand Forks, N. D.; John Severn, re-elected, Jamestown, N. D.; Frank N. Whitman, Devils Lake, N. D.; Mayor Berg, re-elected, Dubuque, Ia.; T. Hassell Gibbes, Columbia, S. C.; A. A. Graves, re-elected, Saginaw, Mich.; Jay H. Neff, Kansas City, Mo., David S. Rose, re-elected, Milwaukee, Wis.; George W.

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MACHINERY AND TRADE

Palmer Hollow Concrete Blocks in Waterloo, Ia.

An affidavit, dated April 13, 1904, by A. O. Tabor, secretary and manager of the Waterloo Artificial Stone Company of Waterloo, Ia., has been received in which he certifies that he is manager of the Waterloo Artificial Stone Company of Waterloo, Ia., and had entire charge of manufacturing and delivering the stone which was used in the construction of the factory buildings at Westfield, Waterloo, Ia.; that all the stone used in the construction of the main building of the Waterloo Threshing Machine Co. was manufactured by the Waterloo Artificial Stone Co. on two of the Noyes F. Palmer cast stone presses and that all of the fractional blocks, joist blocks, pilaster blocks and corner blocks beside all but $1,000 worth of the 32-inch regular blocks, used in the main building of the J. S. Kemp Mfg. Co., were made by the said Waterloo Artificial Stone Co. on two of the said Noyes F. Palmer machines.

Pictures of these buildings have been used in the advertisements of other makers of hollow concrete block machines, which might lead some persons to assume that they were not constructed with blocks made on the Noyes F. Palmer machine. This led to the preparation of the affidavit quoted above, to correct any misunderstandings which might arise from the manner in which the cuts of the buildings named have been used.

A Pocket Rope Caliper.

The A. Leschen & Sons Rope Company of St. Louis, Mo., is distributing to

Cement Roofing Tile and Building Blocks.

A comparatively new use for cement is in the making of roofing tile. The latest development in this line has been made by Mr. C. C. Christensen, the president of the Perth Amboy Cement, Stone and Roofing Tile Company of Perth Amboy, N. J. He makes the tiles square, of one square foot net area, with raised ridges on two edges on the under side and corresponding indentations on two edges on the

MACHINE FOR MAKING CEMENT ROOFING TILE.

upper side, so that the tiles fit tightly and are water-proof. They are set diagonally. Different coloring matters can be used so that patterns or lettering can be set out on the roof if desired. The

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tiles have been subjected to a severe heat test, being exposed for some time to 2,400 degrees temperature without crumbling or breaking or other effect, except a slight discoloration and reduction in weight.

The company also makes a cement stone in the usual hollow form shown in the accompanying cut. Cement sewer pipe is also made on a German machine. The company is prepared to supply the demand for stone, tile and sewer pipe within reach of its factory, and also to supply its patented machines for making the tile.

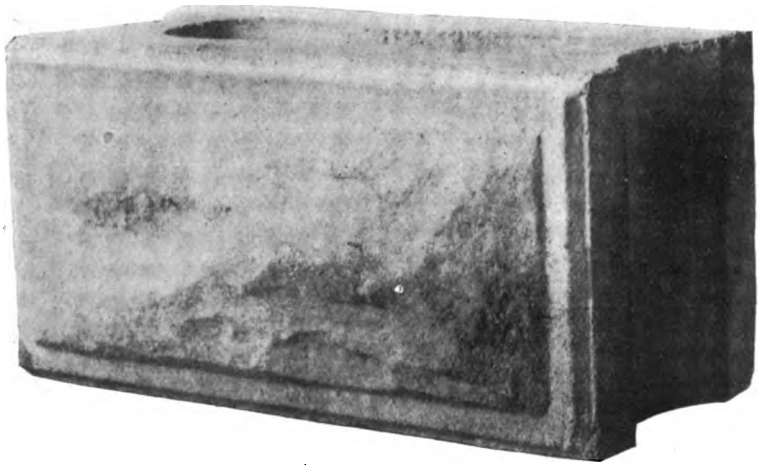
A Bituminized Fiber Conduit.

Elsewhere in this number of Municipal Engineering will be found an article on the desirable features for an underground conduit for electric wires. One of the conduits which approaches most closely to these ideals is that made by the American Conduit Company, 170 Broadway, New York City. This conduit is made of a fiber which is thoroughly saturated and coated with a bituminous compound and compressed to a homogeneous, non-absorptive, smooth tube. The joints are made by turning down the ends of the tubes on inside and outside alternately, accurately and smoothly, so that the end of one tube will slip into the opposite end of the next tube and form a smooth, straight surface both inside and outside. Bituminous paint or dip makes the joints tight without wrapping.

Special claims are made for the non-conducting nature of the tube, thus preventing electrolysis, and insuring insulation; its smooth and non-abrasive surface, thus preventing abrasion of cables drawn through it; lightness in weight, saving cost in handling and permitting the making of long sections, thus reducing the number of joints. These are in addition to the ordinary requirements every successful conduit must meet, which are set forth in the article referred to and which the bituminized fiber conduit meets satisfactorily.

A Vitrified Electric Conduit.

To meet the demands for a multiple duct conduit the Standard Vitrified Conduit Company, 39-41 Cortlandt-st., New York City has developed a system of conduits and methods of alignment and of retention in line which seems to meet every requirement. The conduits are made with 1, 2, 3, 4, 6, and 9 ducts for standard construction and can be made in any form or size ordinarily required.



HOLLOW CONCRETE BLOCK MADE BY PERTH AMBOY CEMENT STONE AND ROOFING TILE CO.

The method of aligning and holding the sections of the conduit in line is specially noteworthy. In the partition between each two ducts, at the outer surface of the conduit, is located a rectangular or diamond shaped channel open along one edge. Into this channel a steel pin of the same shape may be slipped. In laying a section of the conduit, these pins are slipped into the channels of the section already laid, a lug in the channel stopping it at two inches from the end. The new section is then slipped into place, the projecting ends of the pins being slipped into the channels in the new section. The faces of the

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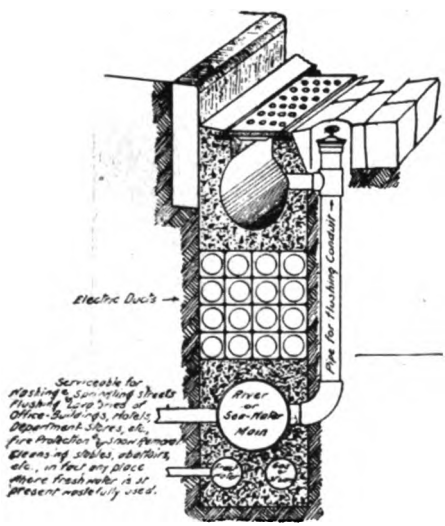
sections thus fit closely together and the pins keep them in position. When a section of laid conduit is to be removed the lugs at one end of the pins can be knocked out and the pins slipped back, thus permitting the section to be lifted out without disturbing its neighbors.

The company also makes a self centering single duct conduit, a lug on the end of one section fitting into a recess on the other. Short lengths and specially cut forms are made for passing round curves, thus making a surface as smooth as can be made in a conduit laid in this form. The company also makes special forms of sections and bricks for connecting with manholes, and other conveniences for the work of laying conduits.



MARRIOTT'S CURB TESTING SYSTEM.

A New System of Removal of Street Water and Refuse.

The accompanying cut shows the most elaborate form proposed by Mr. James C Marriott, 15 William-st., New York, for a system of curb conduits to serve the many purposes of street cleaning and removal of water, snow and refuse, also fire protection, flushing water, electric, water and gas conduits.

The simplest form includes only the curb conduit and the occasional pipe connections with water mains for flushing purposes. The conduit may be within a large concrete curb, with longitudinal openings connecting with the [illegible] trolled streams from the water mains can wash them down to the nearest catchbasin, sewer connection or stream. This should greatly facilitate the removal of these substances and aid materially in keeping streets clean.

The water main can be laid in the same trench, embedded in concrete or not, also gas main and electric conduits. The illustration shows all these in one suggested relation and also a separate system of water pipes for flushing and possibly fire purposes.

The Manufacture of Cement Pipe.

There have been many inquiries recently for machines or molds for mak ing cement pipe. The Cement Tile and Tile Mold Manufacturing Company of Sac City, Ia., now offers practicable molds for this purpose. They are made of good sheetiron and are economical and durable. The outside mold is made in two pieces and the inside mold in three pieces, hinged with clasp hinges. The inside mold opens inwardly and is removed as soon as the tile is made. It is then placed in the next outside cylinder, which is set on the bottom board beside the tile just made. The hopper is then set on the inside cylinder so as to run the mixture down as it is thrown on the hopper. It must be tamped well. One man can in ten minutes set up the mold and make the tile. The usual length of tile is 24 inches, but they can as readily be made any length from 12 to 36 inches. The tiles are used for making sewer pipe, road culverts and well curbing as well as for drain tile.

The manufacturers recommend a mixture of four parts of fine sand or fine gravel and sand, to one of cement, mixed dry and then dampened. They claim that they can compete with clay sewer pipes and tile in all sizes more than 10 inches in diameter.

Cement Blocks Made Under Pressure.

Mr. W. H. Fisher, 384 Second-st., Memphis, Tenn., has constructed and puts on the market his No. 4 hydraulic press for making concrete blocks, which exerts a total pressure of 200 tons upon the four blocks or the thirty-two bricks which can be put into it at one time. The No. 2 press gives a pressure of 100 tons. Both are automatic, making their action as

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Bituilthic Pavement For Shreveport, La.

On March 31 a contract for 37,000 square yards of the bituilthic pavement was awarded by the City Council of Shreveport, La., to the Nashville Roofing and Paving Company. Prior to the awarding of this contract a committee consisting of the Mayor, City Engineer and other officials of the city of Shreveport made an extended tour of investigation of the bituilthic pavement, and in consequence of their unanimous approval an additional award of 10,000 square yards was made at a special meeting of the Shreveport City Council held on Monday evening, April 4.

Artificial Asphalt for Street Pavements.

A petition has been presented to the Board of Public Works of San Francisco asking that the general paving specifications now in force in that city be amended so as to permit the use of refined asphalt in all original work. These specifications at present restrict original work to "bituminous rock" and "natural rock asphalt." Refined asphalt is only acceptable for resurfacing bituminous rock pavements. No change can occur unless the specifications are revised, for it is impossible for competition to enter into the business as they now stand.

The petition is made in the interest of the California petroleum refining companies and it is reasonable. The base of most, if not all, of the crude petroleum thus far developed in California is asphalt. The only execption in mind is a well in the Newhall district, which is claimed to have a paraffin base. But little if any oil is now being drawn from that well, although when the oil measure was first tapped it proved to be a gusher. The Kern County product is rich in asphalt. In fact, the percentage of asphalt contained in it is so large that it increases the difficulties of piping it to tide water. In the process of refining this crude petroleum, asphalt constitutes one of the most abundant and important of the by-products. But instead of being used at home for street paving, it is shipped East for a market. There it has succeeded in winning its way into popular favor despite the opposition it

If the general specifications of street paving are amended by the elimination of the word "natural" in the conditions applying to asphalt paving, which now reads, "It must be prepared by mixing a refined, natural, solid asphalt with a liquid asphalt or residuum of petroleum oil," etc., the asphalt by-product of the California refineries can enter into the competition with the bituminous rock exclusively supplied by the Santa Cruz quarries.

The Board of Public Works favors the amendment of the ordinance to this effect and recommends it to the Board of Supervisors.

Trade Publications.

The Triumph automatic combined sand gravel digger, elevator and grader, designed and constructed by the C. O. Bartlett & Snow Comapny, Cleveland, O., is illustrated in a new descriptive circular.

The Climax Road Machine Company, Marathon, N. Y., catalogues its stone and ore crushers, elevators, screens, bins, distributing wagons, engines, horse rollers, road machines, scrapers, plows, and road bridges.

Tucker & Vinton, Inc., 156 Fifth-ave., New York, have issued a handsomely illustrated booklet on steel-concrete structures, of which they have built many, in the form of filter plants, dams, basins, pumping stations, shops, floors, bridges, etc., including some very artistic ornamental work in concrete.

"Long Distance Transportation of Ores and Aerial Wire Rope Tramways" is the title of a well-illustrated pamphlet bearing the date 1904 and issued by A. Leschen & Sons Rope Company, St. Louis, Mo.

The Kelly-Springfield Road Roller Company, Springfield, O., has issued its 1904 catalogue of road rollers and accessories, of which it reports over 850 now in use.

The Cement Machinery and Manufacturing Company of Burlington, Ia., issues a circular illustrating its adjustable hollow cement stone machine and its product, a post machine and cement sewer pipe molds.

The Harmon S. Palmer Hollow Concrete Building Block Company has issued a new book of testimonials showing the

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pany, Broadway-Maiden Lane Building, New York City, issues an elaborately illustrated catalogue of its methods of laying multiple duct conduits of various styles and materials.

The Charles Warner Company of Wilmington, Del., and Philadelphia, Pa., issues a fully illustrated book of testimonials for Nazareth Portland cement, putting special emphasis on the value of the cement for sidewalk work and upon its uniformity in quality, all the cements being made in one mill.

Trade Notes.

ASPHALT.

The Barber Asphalt Paving Company has purchased the plant of the Warren-Scharf Asphalt Paving Company, in the eastern part of Muncie, Ind. The plant was erected about ten years ago, when the first asphalt pavement was constructed in Muncie.

CEMENT.

The Elk Rapids Portland Cement Company of Elk Rapids, Mich., and the Bay Shore Lime Company of Bay Shore, Mich., which were last fall placed under the same ownership and management, have been merged and will operate as the Elk Portland Cement and Lime Company. The plant is located at Elk Rapids, Mich., on the Pere Marquette Railroad and Lake Michigan, and the general offices are at Petoskey, in charge of E. M. Sly, secretary and treasurer. The capacity of the mill is 700 barrels per day, product made from lime rock and shale clay. The officers of the company are as follows: R. E. Olds, president, Lansing, Mich.; F. R. Williams, vice-president, Elk Rapids; Homer Sly, vice-president; E. M. Sly, secretary and treasurer, Petoskey; E. R. Sly, general manager, Bay Shore.

The Sunflower Cement and Plaster Company, Tampa, Kas., has been incorporated.

The Alpha Portland Cement Company, Camden, N. J., has been incorporated in Illinois.

The new cement works of the New York Cement Company, on Rosendale Plains, near Kingston, N. Y., are in operation.

The Lone Star Portland Cement Company, New York City, has been incorporated by Baxter Morton, R. L. Peterson and C. W. Sinn of New York City.

The contract for the concrete work on the new cement factory to be built in Bellevue Mich., has been awarded to N. J. and W. J. Meagher of Bay City. O. Button is the engineer in charge of the work.

W.H. Andrews of Rushsylvania, O., has been inspecting cement land in Wilson County, Ohio, for parties contemplating the establishment of a plant, according to press reports.

A large deposit of cement rock, covering an area of several acres near Salida, Colo., has been located at the mouth of Pass Creek by W. H. Camp, a ranchman. An analysis shows the rock to be equal to the best Portland cement rock. Samples of the rock are on exhibition at the Board of Trade room, in Salida.

The Acme Cement & Plaster Company, of St. Louis, Mo., have begun the construction of a large, modern cement plaster mill at Cement, Caddo County, Ok., for the manufacture of cement from the gypsite beds, which cover an area of 600 acres.

Lars Larson, of Faaborg, Denmark, has assumed charge of the new cement roofing factory in Spencer, Ia.

The Iroquois Portland Cement Company, which has been closed for the installation of new machinery, is in operation again, at Caledonia, N. Y. The plant of the Caledonia Marl & Lime Company will be enlarged during the year.

A contract has been let for constructing a large cement plant, with a capacity of 4,000 barrels, at Chanute, Kas. J. R. Patterson, president of the Peerless Portland Cement plant at Union City, Mich., is at the head of the company, and associated with him are other members of that company and capitalists of Michigan.

Work has commenced on the new plant of the Bancroft Peat Fuel & Cement Company, one mile south of Bancroft, Mich.

Press reports of April 11 state that the Standard Portland Cement Company, at Frankfort, Mich., has revoked the contract for the construction of a plant at Edgewater, and will locate elsewhere. Ex-Judge Aldrich, of Detroit, is president of the company.

The Pittsburg Cement Company, has purchased the Burkey farm, one mile from Cumberland, Md., near Narrows Park, containing 359 acres, and another tract near Hancock, and will erect cement mills. J. H. Beall is president, Carroll Forster secretary, and Jas. H. Jordan treasurer of the company.

The Fosston Cement Company, Fosston, Minn., has been organized by L. Hallum, F. M. Johnson, and W. E. Black.

S. M. James, 247 Fairview-ave., Connellsville, Pa., advises us that the U. S. Portland Cement Company has secured sixty-two acres of cement land in Connellsville township, and will build a large modern cement plant, at a cost of $200,000. Robert Garland, Henry Shenk, and other parties of Pittsburg are interested.

F. L. Smidth & Co., formerly located at 80 William-st. and 66 Maiden Lane, New York, move about May 1 to the J. Monroe-Taylor building, 39-41 Cortlandt-st., where they will have a more desirable location and larger offices.

CONCRETE BLOCKS.

We are advised by the Cement Machinery Co., Jackson, Mich., that they have just moved into their new factory, located at 220-226 N. Jackson-st., which is equipped with the latest electrically-driven tools. The large demand for the company's machines has not only ne-

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cessitated their taking up larger quarters, but they have been obliged to run the factory night and day to fill orders for their machines.

The Penville Concrete Co., Penville, Ind., has been incorporated by H. C. Strong, Elza N. Cory, C. E. Caylor, M. G. McCarty, L. G. Walling and Wm. C. Waltz.

The Richmond Concrete Construction Co., Richmond, Ind., has been incorporated to manufacture concrete fence posts, verandas, building blocks, and ornamental designs of all kinds. Atwood L. Jenkins is president, Oliver Test, general manager and Walter Test, secretary and treasurer.

The Racine Cement Walk Co., Racine, Wis., has been incorporated to lay cement walks and floors.

The Concrete Block Co., Cincinnati, O., has been incorporated by Chas. V. Maeschner, E. G. Hopkins, Ben Evans, A. G. Bofinger and John V. Maeschner.

The Queen City Concrete Building Block Co., Cincinnati, O., has been incorporated by M. M. Allen, Alexander Dorn, John H. Bart, Frank M. Winter and Ferd Ritter.

Smith & Grater, Sterling, Ill., have purchased twelve acres of gravel and sand land west of that city, and will purchase machinery for the manufacture of artificial stone blocks for building purposes.

E. L. Jones, 166 Race-st., Chillicothe, O., advises that he is interested in cement blocks and pavements.

H. H. Hill, Corry, Pa., writes that he desires the names of firms that manufacture cement window sills and tools for brick buildings.

A. J. Garner, Madison, S. D., has purchased a site and will erect a building for the manufacture of hollow cement building blocks, using the Stewart machine. The name of the company is the Madison Cement Co., and Mr. Garner is president.

Cement blocks will be used in building a fifty-foot extension to the plant of the George Carlon Cement Block Co. at Oskaloosa, Ia.

W. E. Cook, F. A. Tisdale and others of Ottumwa, Ia., will manufacture cement building blocks, floor tile, sewer tile, etc.

M. Kammerer, Fairbury, Ill., has obtained a patent for making cement blocks.

George Clark, Clarksville, Ia., has put in operation a plant for manufacturing cement blocks for foundations and porch pillars.

J. D. Tann & Co., Princeton, Minn., contemplate the manufacture of artificial stone.

George Seavey, Cedar Falls, Ia., has purchased machinery for the manufacture of concrete blocks.

Russell Bros., Waverly, Ia., have secured the Miracle hollow block rights for Bremer and Butler counties.

W. D. Rowe, a cement sidewalk contractor of Crookston, Minn., will manufacture hollow blocks.

Godby & McWherter, Jamestown, N. D., are erecting a plant at the company's cement works for the manufacture of cement blocks.

The Montana Building Block Co., Havre, Mont., is erecting a plant for the manufacture of hollow building blocks.

A cement block plant has been established at Litchfield, Minn.

Candy & Ladd, Webster, S. D., will manufacture cement blocks for building purposes and cement tiles for walks.

D. A. Dinnie, Minot, N. D., has purchased machinery and will engage in the manufacture of cement hollow building blocks.

J. F. Armstrong, Eldora, Ia., will manufacture cement building blocks.

W. D. Rowe, Ada, Minn.. has purchased machinery for the manufacture of cement building blocks.

John Naslund, Delano, Minn., contemplates moving to Springfield, Minn., where he will continue in the manufacture of tile sidewalks.

Peter Parson of the Northfield Stone Walk Company, Northfield, Minn., has installed machinery for the manufacture of concrete hollow blocks.

C. P. Lungard, Sleepy Eye, Minn., will move to Springfield, Minn., where he will engage in the cement sidewalk business.

The establishment of a cement sidewalk plant is contemplated at Morris, Minn., by Martin Peterson of Minneapolis.

O. Nordquist and J. G. Nelson of Granite Falls, Minn., will establish a plant at Lake City, Minn., as the Lake City Artificial Stone Company, and will manufacture cement sidewalk tiles.

A cement sidewalk tile plant is being built at Princeton, Minn., by F. W. Milbrath.

Thomas McCarthy has acquired property at Davenport, Ia., and will manufacture concrete building blocks.

Frank Terry, Findlay, O., is manufacturing concrete blocks for the new plant of the Van Buren, Heck & Marvin Company.

I. L. Shaw, Gibson City, Ill., has invented a machine for the manufacture of cement stone building blocks.

The directors of the Frost Concrete Stone Company, located at Dows, Ia., are considering a proposition to move the headquarters of the plant to Waterloo.

E. W. Hartley, F. W. Scanling and F. E. Proctor, Chrisman, Ill., have purchased machinery and leased a tract of ground and will manufacture artificial stone.

The Aurora Artificial Stone and Construction Company, Aurora, Ill., has been incorporated to manufacture artificial stone and cement blocks by John and Jacob Binder and Christian Armbruster.

The Fond du Lac Brick & Cement Company, Fond du Lac, Wis., has contracted for 5,000 barrels of Portland cement to be used in the manufacture of cement brick, of which the company expects to manufacture between 20,000 and 28,000 a day.

N. M. Lester, Butler, Mo., advises us that, through Municipal Engineering, he received a very large number of letters

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and catalogues from block machinery manufacturers, but he has not yet decided which machine to purchase.

The Cement Products Company, of Wilmington, Delaware, has enlarged its new special machinery for making 50,000 bricks per day of ordinary wet concrete, such as specified by all engineers to go under high buildings, railroad construction and sidewalks. The bricks are impervious and of any desired color. The cost will be $3.50 for common and $5.00 for face brick. A number of buildings will be built of them this summer. For New York standard size, common brick, one barrel Portland cement and one and one-fourth yards of ordinary sand is used per 1,000 bricks.

The Enid Artificial Stone Company, Enid, Ok., has been incorporated by J. P. Marshall, C. S. McClellan, and J. W. Tarr.

The National Artificial Stone Company, Chester, Pa., has been organized.

The Aurora Artificial Stone and Construction Company has been incorporated to manufacture artificial stone and cement blocks, by John Binder, Jacob Binder and Christian Armbruster.

S. S. Brandon & Son, concrete work contractors of Mobile, Ala., have purchased a Powers concrete mixer and will make and lay artificial pavements and floors.

LIGHTING AND POWER.

The New Castle Gaslight Company, Wilmington, Del., has been incorporated to manufacture gas from coal or other material.

An electric lamp combine has been formed in New York city to be known as the General Electric Lamp Company. The price of incandescent lamps will be advanced 2 cents each, and only two grades will be furnished to the trade. This agreement will place that corporation in absolute control of the electric lamp trade.

Newly incorporated electric and gas companies: Fort Halifax Power Company, Waterville, Me.; Manlius Gas and Electric Company, Manlius, N. Y.; East Brady Gas Company, East Brady, N. Y.; Montgomery Light and Power Company, Montgomery, N. J.; Fremont Power and Light Company, Fremont, O.; Baxter

The Cement Machinery Co. of Jackson, Mich., has just established a branch office at 410 Massachusetts Building, Kansas City, Mo., where a full line of machinery is on exhibition. The company has just shipped a carload of Normandin machines to Columbus to be used exclusively by the Columbus Cement Stone Co. The plant at Jackson is running day and night, and the company has placed an order for additional lathes and planers.

MISCELLANEOUS.

The Commercial Engineering Company, Camden, N. J., has been incorporated to conduct mechanical, electrical and civil engineering, by E. G. O. Bleakly, Charles Budge and U. M. Wilson.

The city of Meadville, Pa., has purchased a street sweeper of the Austin-Western Manufacturing Company of Chicago.

The King-Lambert Construction Company, Des Moines, Ia., has been incorporated to construct bridges, manufacture brick, quarry stone and conduct a general contracting business.

The White Engineering Company, Marion, O., has been incorporated to manufacture valve gears and portable engines. The company will establish a plant in Marion.

The plant of the defunct Wabash Bridge and Iron Company, Wabash, Ind., has been purchased for $20,230 by William A. Reed of Cleveland, O.

The Texas Stone Company, Beaumont, Tex., has been incorporated to own and maintain rock quarries by O. M. Stone, J. G. Tullis and J. L. Megathlin.

The Simplex Concrete Piling Company, Washington, D. C., has been incorporated by Frank Shuman, Joseph H. Crawford, and John Stewart.

The United States Wood Preserving Company, Perth Amboy, N. J., resumed operations April 4 after being closed down three months on account of the severe weather.

The city of Mankato, Minn., has purchased a street sweeper of the Austin-Western Manufacturing Company of Chicago.

PAVING.

Birmingham, Ala., after a trial of the bitulithic pavement last year, has awarded additional contracts this year. The city of Pawtucket, R. I., the first city to adopt the bitulithic pavement, has made appropriations for 28,000 sq. yds. Shreveport, La., has awarded 116,000 yds. to the Nashville Roofing and Paving Company, 86,000 yds. for bitulithic pavement and 30,000 sq. yds. for brick. New Bedford, Mass., the second city in the United States to use the bitulithic pavement, has appropriated $20,000 for additional quantities this year. This is the largest amount New Bedford has ever spent in one year for street paving. Portland, Me., has awarded contracts for bitulithic pavement to Warren Brothers' Company Portland, Ore., ordered $150,000 worth of bitulithic pavement, and delayed awarding contracts for further investigation, but after inspection of the pavements laid at Tacoma, Wash., has proceeded to award contracts.

PURCHASE OF MACHINERY AND TOOLS.

Paul S. Carter, purchasing agent in the United States for the government of the Philippine archipelago, advises us that he will be in the market for a complete outfit of machinery for making hollow concrete blocks, and desires to communicate with manufacturers. Address Paul S. Carter, War Dept., New York City.

Daniel Hess, Waynesboro, Pa., writes that he is interested in hydraulic building block machines, and desires all necessary information regarding all sizes of the machine, their cost, where they can be obtained, and how soon they could be

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shipped. A company has been organized and contemplates installing a machine very shortly.

The purchase of a stone crusher is contemplated at Canastota, N. Y.

Bids will be asked for soon by C. S. Linch, of Linch & Stover, 916 Pennsylvania Bldg., Philadelphia, for crushers and other graphite machinery for a graphite plant, which that firm has purchased. Catalogues, etc., are desired.

We have been directly advised that the following people are possible purchasers of machinery and tools as follows:

Frank M. Davis, 332 Hector-st., Conshohocken, Pa., concrete building block machine.

D. H. Craw, Ravena, N. Y., stone crushing plant, steam drills, sidewalk tools, etc.

Ward Bros., Berlin, N. H., general contractors' supplies.

J. H. Boring, 524 Heylman-st., Ft. Scott, Kas., cement block machinery.

Arthur Caron, Box 357, Clayton, N. Y., concrete mixer.

Nick Peay Construction Co., Little Rock, Ark., sewerage excavation and masonry tools.

F. J. Bernhart, Attica, Ind., concrete machine.

J. H. Conard, Corinth, N. Y., concrete and road machinery and tools.

C. C. Creager, Urbana, O., concrete mixer.

William H. Grady, Bangor, Me., general contractors' supplies.

B. F. Adams, 200 Edward-st., Marion, O., concrete mixers and building block machines.

Myron Oothoudt, Courtland, N. Y., cement block machinery.

Clemmer & Johnson, Hicksville, O., tools for curb and gutter work.

Charles E. Sockler, 105 N. Main-st., Kingfisher, Ok., cement building block machine.

E. S. Chase, Belding, Mich., mixer for concrete for walks.

Charles T. Derr, Shawnee, Ok., general municipal contractors' supplies.

George C. Hess, Morgantown, W. Va., concrete or mortar mixer.

J. A. Kunkey, Lemoyne, Pa., plaster machinery.

Benell Bros. & Co., 1215 Carterett-ave., Pueblo, Colo., concrete block machine, concrete mixer, top-coat mixer.

M. J. Buehler, Portage City, Wis., building block and concrete machinery.

William Weber, Beaumont, Tex., plumbing, heating, cement and brick machinery and tools.

Philip Beaulac, Sr., 61 Feeder-st., Sandy Hill, N. Y., cement mixer for sidewalks and cement block machine.

E. T. Belote, 21 W. Chestnut-st., Asheville, N. C., cement tools.

James M. Bobbitt, 210 Eleventh-st., Lynchburg, Va., hand power machine for sand and cement brick.

Valentine Construction Company, St. Marys, Pa., building block and concrete tools in general.

George Blaine, Waverly, Ia., cement walk tools and block machinery.

James Maskiell, Jr., 2 Welling-st., Long Island City, N. Y., concrete building block machine.

Joseph Davey, 108 N. State-st., Big Rapids, Mich., cement working machinery and tools.

S. C. Aregood & Son, 211 W. Arch-st., Pottsville, Pa., boiler and engine for construction work and hoisting crabs.

William L. Crow, 287 Fourth-ave., New York city, machinery for general contractor and builder.

McGehee & Normoyle, Roanoke, Va., concrete building block machinery.

John M. Rooney, Nyack, N. Y., machinery and tools for cement work.

Easum Bros., Colfax, Wash., hollow concrete block machine and brick machine.

Harry L. McLimans, West Grove, Pa., buyer of machinery or tools for all kinds of stone work.

M. H. Logan, Taylor, Tex., cement molds and cement tools.

F. G. Gulzone, Flandreau, S. D., concrete mixer and cement block machine.

Octavius Worner, 1529 Porter-st., Philadelphia, Pa., machinery and tools for roofing and cement work.

John H. Rush, 1250 Queen-st., Pottstown, Pa., concrete and finishing tools.

Joseph C. Watson, 4512 Thorpe-lane, Philadelphia, Pa., machinery and tools for general contractor.

Crane & Veeder, 69 Edison-ave., Schenectady, N. Y., contractors' tools and cement sidewalks.

Houston Bros. & Co., Thirty-second-st. and Pennsylvania Railroad, Pittsburg, Pa., tools for cement sidewalks and other cement work of this kind.

Ed Z. Conard, Pawnee City, Neb., stone cutters and bricklayers' tools.,

Fisher & Brotherton, Delphos, O., cement tools and concrete mixer.

L. D. Pettit, 2933 Rockfiller-ave., Everett, Wash., sand brick press, Roman finish.

Frank C. Sewell, care Ironside, Rannie & Campbell, Inns of Court, Vancouver, B. C., machinery used in heavy construction work, street paving and bridge building.

S. P. White, Vancouver, Wash., cement and grading machinery and tools.

Ferro-Concrete Construction Co., 46 Mitchell Building, Cincinnati, O., concrete mixers and hoisting engines.

J. F. Aldrich, manager of the Tacoma Concrete & Artificial Stone Co., Tacoma, Wash., is interested as a possible purchaser of heaters, kettles, shovels and barrows.

PURCHASE OF MATERIALS.

We are advised by Pettyjohn Bros., manufacturers of concrete block machines at Terre Haute, Ind., that they are in the market for Portland cement for both themselves and for plants where they have sold their machines, and would like to receive quotations from manufacturers.

L. Karr, Yankton, S. D., advises us that he is interested in cement work, and

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contemplates considerable building the coming season, in which he will use some cement.

We have been directly advised by the following people during April that they are interested as possible buyers of materials as follows:

—Cements—

D. D. Wagner, Tarboro, N. C.
D. H. Craw, Ravena, N. Y.
W. J. Jacobs, Dunn, N. C.
J. H. Boring, 524 Heylman-st., Ft. Scott, Kas.
Arthur Caron, Box 357, Clayton, N. Y.
F. J. Bernhart, Attica, Ind.
William H. Grady, Bangor, Me.
B. F. Adams, 200 Edward-st., Marion, O.
Myron Oothoudt, Cortland, N. Y.
Smith Lumber Company, Portsmouth, O.
E. S. Chase, Belding, Mich.
Crane & Veeder, 69 Edson-ave, Schenectady, N. Y.
H. H. Osgood, 125 Main-st., Bradford, Pa.
Ed. Z. Conard, Pawnee City, Neb.
Walter Bashan, P. O. Box 593, Lake Geneva, Wis.
James Gibbs, Mount Carmel, Pa.
George C. Hess, Morgantown, W. Va.
J. A. Kunkel, Lemoyne, Pa.
Benell Bros. & Co., 1215 Carteret-ave., Pueblo, Colo.
M. J. Buehler, Portage City, Wis.
William Weber, Beaumont, Tex.
J. A. Silver, Appleton, Wis., car load Vulcanite, Whitehall or Universal, at once.
E. T. Belote, 21 W. Chestnut-st., Asheville, N. C.
Valentine Construction Company, St. Marys, Pa.
George Blaine, Waverly, Ia.
Joseph Davey, 103 N. State-st., Big Rapids, Mich.
Wm. L. Crow, 287 Fouth-ave., New York City.
R. C. Sanders, Brandon, Vt.
H. H. Hill, Corry, Pa.
McGehee & Normoyle, Roanoke, Va.
Easum Bros., Colfax, Wash.
M. H. Logan, Taylor, Tex.
F. B. Gulzone, Flandreau, S. D.
J. H. Hines, Aiken, S. C.
Octavius Worner, 1529 Porter-st., Philadelphia, Pa.
E. D. Adams, 231 Spring-st., Sayre, Pa.
Henry A. Schneider, Anderson-ave., Port Richmond, N. Y.
L. D. Pettit, 2933 Rockfiller-ave., Everett. Wash.
Ferro-Concrete Construction Company, 46 Mitchell Bldg., Cincinnati, O.
S. P. White, Vancouver, Wash.

—Brick.—

J. H. Boring, 524 Heylman-st., Fort Scott, Kas.
Wm. H. Grady, Bangor, Me.
Myron Oothoudt, Cortland, N. Y.
Benell Bros. & Company, 1215 Carteret-ave., Pueblo, Colo., paving brick.
R. C. Sanders, Brandon, Vt.
J. H. Hines, Aiken, S. C.
W. J. Jacobs, Dunn, N. C.

—Building Blocks.—

Valentine Construction Company, St. Mary's, Pa.

—Gravel.—

B. F. Adams, 200 Edwards-st., Marion, O.
E. T. Belote, 21 W. Chestnut-st., Asheville, N. C.

—Crushed Stone.—

J. H. Boring, 524 Heylman-st., Fort Scott, Kas.
Geo. C. Hess, Morgantown, W. Va.
Crane & Veeder, 69 Edson-ave., Schenectady, N. Y.
Ed I. Conrad, Pawnee City, Neb.

—Miscellaneous.—

J. H. Boring, 524 Heyland-st., Ft. Scott, Kas., sand and lime.
J. H. Conard, Corinth, N. Y., masons' supplies.
Myron Oothoudt, Cortland, N. Y., lime.
Clemmer & Johnson, Hicksville, O., red crushed sand.
H. H. Osgood, 125 Main-st., Bradford, Pa., all kinds materials.
George C. Hess, Morgantown, W. Va., sand.
J. A. Kunkel, Lemoyne, Pa., calcined plaster.
William Weber, Beaumont, Tex., all kinds of materials.
William S. Post, Summit, N. J., materials for building contractors.
William L. Crow, 287 Fourth-ave., New York City, building materials.
R. C. Sanders, Brandon, Vt., calcined plaster, tile, etc.
H. H. Hill, Corry, Pa., building materials of all kinds.
John M. Rooney, Nyack, N. Y., mason building materials.
Easum Bros., Colfax, Wash., lime, mortar, colors, etc.
J. B. Hines, Aiken, S. C., lime.
Octavius Worner, 1529 Porter-st., Philadelphia, Pa., slate, felt, pitch and gravel cement.
E. D. Adams, 231 Spring-st., Sayre, Pa., plastering cements.
John H. Rush, 1250 Queen-st., Pottstown, Pa., cement mineral colors.
Ferro-Concrete Construction Company, 46 Mitchell Bldg., Cincinnati, O., finished stone and sand.
J. F. Aldrich, manager of the Tacoma Concrete & Artificial Stone Co., Tacoma, Wash., is a possible purchaser of cement. tar and asphalt.

SEWER PIPE.

The Jackson Sewer Pipe Co., Jackson, Mich., has begun the manufacture of sewer pipe and concrete catch basins. The company is also using the Normandin cement block machine for the manufacture of cement blocks.

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IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Cincinnati, O.—The Blake Asphalt Maintenance Co. of Cincinnati has repaired the asphalt paving on Plum-st., at 44 cents a square yard. Heretofore the city has paid from $1.50 to $1.75 a square yard.

Louisville, Ky.—The board of park commissioners has decided to make the new Portland cement walks in Central Park have a gravel appearance by sprinkling gravel over the freshly-laid cement walks.

Elgin, Ill.—The Federal Court has directed the receiver of the Federal Asphalt Co. to borrow $25,000 to complete the rock asphalt paving contracts in this city, Belvidere and Sycamore.

CONTEMPLATED WORK.

Chester, Pa.—Paving is proposed for Kerlin-st.

Lisbon, O.—Council has authorized the paving of Lincoln-ave.

Springfield, Minn.—Cement walks are contemplated for Main-st.

Waterloo, Ont.—The construction of cement walks is contemplated.

Arcadia, Fla.—This town voted to issue $5,000 for street improvements.

Pana, Ill.—(Special.)—Brick paving on concrete foundation is contemplated.

Pueblo, Colo.—The property owners on Main-st. have petitioned for paving.

Lake Linden, Mich.—The question of constructing cement walks is being urged. Ordinances have been passed for paving Third and Colby-sts.; also, Lancaster-st.

Decatur, Ill.—N. Morgan-st. will be paved with vitrified brick.—Mayor Shilling.

Phoenix, Ariz.—This city, Mesa and Tempe have voted to build a wagon road to Tonto dam.

Port Jervis, N. Y.—The Board of Trade favors the paving of Pike and Front-sts.

Waco, Tex.—Brick paving is proposed for five blocks of streets.—Allen D. Sanford, Mayor.

Mankato, Minn.—The Board of Public Works has decided to recommend the macadamizing of Rhine-st.

Green Bay, Wis.—Estimates are being prepared for paving Main-st. with various materials.

Tacoma, Wash.—The Retail Grocers' Association is urging the question of street improvements.

Hartford, Conn.—A petition is being circulated asking for a cement or flag walk in Main-st.

Redwood Falls, Minn.—The construction of more than twenty blocks of cement walks has been authorized.

Altoona, Pa.—Mayor Hoyer and Robert B. Vaughn, Street Commissioner, favor asphalt for street paving.

Oakland, Cal.—A resolution has been adopted for macadamizing Nineteenth-ave.—F. R. Thompson, cy. clk.

Evansville, Ind.—The property owners on Walnut-st., from Eighth to Canal, have petitioned for asphalt.

Ashtabula, O.—An ordinance has been given first reading to proceed with the construction of S. Main-st.

St. Paul, Minn.—Plans and estimates have been prepared for paving Eighth and Sibley-sts. with asphalt.

Rochester, N. Y.—The residents of Portland-ave. desire a Medina block pavement from North to Clifford-sts.

Memphis, Tenn.—Plans have been prepared by Jas. A. Omberg, Jr., cy. engr., for paving Second-st., with asphalt.

Port Huron, Mich.—The residents on Water-st. have petitioned for repaving with cedar blocks with stone curbing.

Butler, Pa.—The citizens of Shenango twp. have petitioned the county commissioners to macadamize Butler road.

Danville, Ill.—An ordinance has been recommended for adoption providing for grading and graveling Robinson-st.

East Palestine, O.—A petition has been presented to council asking that 12 blocks of E. and W. Main-sts. be paved.

Richmond, Ind.—Plans are being considered for paving N. West-st. with macadam, with cement sidewalks. City Engr. Weber.

Sandusky, O.—The residents on First and Monroe-sts. have petitioned for paving. A resolution is pending for paving Camp-st.

Walla Walla, Wash.—The citizens on Main, Alder and Fourth-sts. have petitioned for paving. Asphalt or vitrified brick is favored.

Decatur, Ill.—The property owners on Powers-ave. will present a new petition to council asking for asphalt paving.

Dowagiac, Mich.—The cy. coun. voted, April 18, to pave Front, Beeson and Commercial-sts. this year at a cost of $50,000.

Meadville, Pa.—City Engr. Pardee has been directed to prepare plans and specifications for completing the Chestnut-st. paving.

Marion, Ind.—The property owners on D-st. and Baldwin and Highland-aves. have petitioned for brick paving and cement walks.

London, Ky.—An ordinance has been passed providing for the construction of stone sidewalks.—J. T. Williams, chmn. bd. trustees.

Perth Amboy, N. J.—A resolution has been passed providing for the macadam-

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izing of a large number of streets.—John F. Reilley, cy. clk.

Oelwein, Ia.—A resolution will be considered for passage May 14 for paving certain streets with asphalt. J. D. Whipps, cy. clk.

Menno, S. D.—The town bd. has directed the construction of 10-ft. cement sidewalks throughout the business portion of this city.

Marshalltown, Ia.—A petition is being circulated to secure brick paving for S. First-st. from Church-st. to Northwestern right-of-way.

Columbus, O.—A resolution has been adopted providing for the construction of cement sidewalks on a large number of streets this summer.

Berkeley, Cal.—A resolution has been passed providing for macadamizing and constructing concrete gutters on Tenth-st. E. Q. Turner, supt. sts.

Denver, Colo.—The property owners on Twenty-third-ave. from Elliott to Homer, and Grove-st. from W. Twenty-third to W. Eighteenth-aves., have petitioned for asphalt paving.

Lexington, Ky.—The joint impvt. com. of the general council decided April 15 to build all new sidewalks of concrete. Patrick Mooney, supt. pub. wks.

Louisville, Ky.—An ordinance will be passed soon providing for about two miles of asphalt paving on Market-st., from Twenty-eighth to river front. Mayor Grainger.

Marion, Ill.—The question of paving the public square and main streets is being considered, and a special election will probably be called. Mayor Denison.

Mankato, Minn.—A petition will be presented to council asking that Second-st. from Thompson to May, and Fifth-st. from Vine to Lime be paved with gravel.

South Amboy, N. J.—The st. com. has been directed to secure estimates of the cost of permanently improving Stevens-ave., Main and Raritan-sts. Mayor Muirhead.

Hamilton, O.—A resolution was passed April 19 for paving B-st. from Ross-ave. to Black-st. bridge with block asphalt, sheet asphalt or vitrified brick.

Lorain, O.—Ordinances were passed April 18 for paving Dexter-st., from Penfield-ave. to B. & O. right of way. Paving is proposed for Fourth-ave. from Broadway to Reid-sts.

Lewiston, Ida.—A resolution was passed April 8 directing the city clerk to notify the residents on Main-st. from Fifth to and gutter on Russel-ave., and brick paving on Banklick and Eighth-sts. George T. Beach, Mayor, J. J. Craig, city clerk.

Atlantic, Ia.—(Special.)—The Iowa Engineering Company is establishing a system of street grades for this city, and as soon as they are adopted considerable cement and brick walks will be constructed.

Belleville, Ill.—(Special.) — Henry F. Merker, assistant city engineer, says ordinances were passed April 18 for paving High, Jackson and Church-sts., but the date of letting contracts has not yet been determined upon.

Lorain, O.—Ordinances have been passed for paving Dexter-st. from Penfield-ave. to B. & O. right of way. The property owners on Fourth-ave. from Broadway to Reid-sts., have petitioned for paving. The B. P. S. has been directed to ask for bids for building stone sidewalks.

Dixon, Ill.—The city council passed ordinances April 18 providing for the construction of cement curbing on Second-st. from Peoria to Hennepin-aves.; macadamizing Seventh-st. from Peoria to Monroe-aves.; paving Fellows-st. from Galena-ave. to Upham Place; cement curbing on First and Second-sts. and Monroe-ave., and other streets.

CONTRACTS TO BE LET.

Marion, Ind.—Bids are asked until 8 p. m., May 17, for street improvements. C. G. Robbins, Cy. Clk.

Vancouver Barracks, Wash.—Bids are asked until May 11 for grading and road building. Const. Q. M.

Nanticoke, Pa.—Bids are asked until May 10 for paving Market-st. with brick. C. L. Fairchild, Boro Secy.

Mankato, Minn.—Bids are asked until May 4 for grading road in section 23, Mankato Twp. Ed Weaver, Co. Audt.

Ft. Des Moines, Ia.—Bids are asked until May 12 for constructing roads and walks at post. Maj. R. B. Turner, Q. M.

Jasper, Ind.—Bids are asked until May 9 for macadamizing and curbing five streets. Alois Beiter, prest. Bd. Trustees.

Ft. Logan Colo.—Bids are asked until May 6 for constructing flagstone sidewalks. Col. J. W. Pope, Ch. Q. M.

Watertown, Wis.—Sealed bids are asked until 2 p. m. May 9 for improving certain streets. George H. Stanchfield, chmn. B. P. W.

Anderson, Ind. — Bids are asked until May 2 for improving portions of Sixteenth-st., including sidewalks. Frank A. Sharp, Cy. Clk.

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gravel road. George W. Alexander, supt. Wood gravel rd.

Rockville, Ind.—Sealed bids are asked until 12 m. May 5 for constructing three gravel roads in Raccoon Twp. J. H. Kerr, chmn. Co. Com.

Petersburg, Ind.—Bids are asked until May 10 for constructing about eight miles of rock or gravel roads in Patoka Twp. T. W. Basinger, Co. Audt.

Bluffton, Ind.—Sealed bids are asked until 10 a. m. May 3, for constructing fifteen miles of gravel roads in Jackson Township. Geo. Mounsey, chairman, county commissioners.

Ft. Myer, Va.—Sealed bids are asked until May 17 for macadam driveways and concrete walks, near Post Exchange. Capt. G. C. Barnhardt, Q. M.

St. Paul, Minn.—Sealed bids are asked until 2 p. m., May 5, for grading Como-ave., from Capitol-boulevard to Jackson-st. John S. Grode, president Board of Public Works.

Canon City, Colo.—Special.—Sealed bids will be received until May 16 for constructing 187,000 square feet of cement sidewalks. W. R. Smythe, City Engineer.

Chicago, Ill.—Sealed bids are asked until 3 p. m., May 6, for brick and cement paving, filling and retaining wall at Doolittle School. Business Manager Board of Education.

Peekskill, N. Y.—Sealed bids are asked until 12 m., May 10, for brick paving on concrete foundation on Division and Water-sts. Albert E. Cruger, Clerk Board Trustees.

Carrollton, Mo.—Sealed bids are asked until 7:30 p. m., May 10, for 6,000 square yards of vitrified brick paving on macadam base, around public scquare. John E. Lynn, Secretary Improvement Company.

Versailles, Ind.—Sealed bids are asked until 1 p. m., May 3, for constructing four miles and 2,320 feet of macadamized roads; also six miles and 4,854 feet of macadamized roads. Nicholas Volz, County Auditor.

Providence, R. I.—Sealed bids are asked until 12 m. May 4 for constructing 4,090-ft. state highway in Tiverton; 2,640-ft. in Little Compton. John H. Edwards, chmn. State bd. pub. rds.

Dayton, O.—Sealed bids are asked until 12 m. May 3 for 1,330 sq. yds. of brick paving and 1,800 lin. ft. protection curbing in an alley; grading and paving with bowlders a number of alleys. Louis Haas, prest. B. P. S.

Cleveland, O.—Sealed bids are asked until 12 m. May 4 for paving St. Clair-st., from Becker to Ansel-aves., with dressed block Medina stone, with curbing, grading, draining, etc. W. J. Springborn, prest. B. P. S.

Woodruff Place, Ind.—Sealed bids are dist. 2 with asphalt; grading, curbing, guttering, building crosswalks, waterways and sidewalks at street intersections. A. F. Parker, cy. engr.

Indianapolis, Ind.—Sealed bids are asked until May 2 for grading, graveling and rolling roadways of Oxford-st. and an alley; asphalt paving on Ohio-st., from Delaware-st. to Capitol-ave., and Pennsylvania-st., from Twenty-fifth-st. to point 377 feet north; building cement walks on Eleventh, Oxford and Dawson-sts. Bids are asked until May 4 for brick paving on Pennsylvania-st. and cement walks on Cornell and Central-aves. and Twenty-fourth-st. M. A. Downing, chmn. B. P. W.

Waukesha, Wis.—Bids are asked until 2 p. m. May 2 for macadam paving on McCall and South-sts. B. P. W.

Minneapolis, Minn.—Bids are asked until 11 a. m. May 2 for graveling several roads. H. R. Scott, Audt.

Bentleyville, Pa.—Bids are asked until May 1 for macadamizing Main-st. R. A. Johnson, Prest. Boro Coun.

New Albany, Ind.—Sealed bids will be received until May 2 for paving Vincennes-st. with vitrified brick. Cy. Coun.

Jeffersonville, Ind.—Sealed bids are asked until 10 a. m., May 2, for constructing a macadam and gravel road in Charlestown Township. Peter Dillon, Chairman County Commissioners.

Geneva, Ind.—Sealed bids are asked until 10 a. m., May 2, for paving Line-st., from east to west corporation line, with vitrified brick or blocks. Jas. H. Kelley, Town Clerk.

Ft. Smith, Ark.—Sealed bids are asked until 9 a. m., May 2, for building sidewalk on south side of North A-st., from Thirteenth to Fifteenth-sts. Henry Kuper, Jr., Chairman Board Public Affairs.

Marshall, Minn.—Bids are asked until 2 p. m. May 2 for building cement walks on and around the court-house grounds. Separate bids will be taken for cement and cement block walks. Thos. McKinley, co. audt.

Shelbyville, Ill.—Sealed bids are asked until 10 a. m. May 2 for 11,852 sq. yds. of brick paving on concrete foundation, with curbing, catch basins, tile, etc., on Morgan and Main-sts. J. C. Westervelt, prest. bd. local impvts.

CONTRACTS AWARDED.

Philadelphia, Pa.—The contract for asphalt repair work has been awarded to W. S. P. Shields.

Bushnell, Ill.—The Tri-City Construction Company has been awarded the contract contract for fifteen blocks of paving.

Grand Rapids, Mich.—Kloote & Vanderveen have been awarded the contract for improving Baldwin-st. for $3,745.

Hartford City, Wis.—The contract for macadamizing Main-st., was awarded

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has been awarded contracts for building cements walks on W. Main and Kinsey-sts .

Lemars, Ia.—Snouffer & Ford, of Cedar Rapids, have been awarded the contract for paving the principal streets of this city.

Kenton, O.—The contract for paving N. Detroit-st. has been awarded to Kelly Bros., of Portsmouth, O., at $1.44 a square yard.

Princeton, Ind.—The contract for combined curb and gutter for nine streets was awarded to C. P. White, of Booneville, Ind.

Osgood, Ind.—The contract for building twenty-two miles of pike in Adams twp. has been awarded to Chas. Calvert, of Scottsburg, for $42,719.99.

Menominee, Mich.—John O. Jones of Racine has been awarded the contract for paving Grand-ave. with vitrified brick for $23,247.85.

Wilmington, Del.—The contract for building ¾ mi. of road in Georgetown was awarded April 5 to the Christian Construction Company for $5,430.

Oshkosh, Wis.—John Monahan was awarded the contract for macadamizing Monroe-ave. at 60c for macadam work and 63c for cement curb and gutter.

Duluth, Minn.—P. McDonnell was awarded the contract April 18 for paving First-ave. East from the railroad to Superior-st. with sandstone blocks, for $3,933.75.

Toledo, O.—The contract for paving Millard-ave. from Jessie-st. to Duck Creek has been awarded to Garrigan Bros. for $17,355.50 for Harris block or broken stone.

Terre Haute, Ind.—The contract for concrete sidewalks and stone curbing on S. Third-st. was awarded to Donn M. Roberts at 9 9-10c a sq. ft. for sidewalks and 34c a ft. for curbing.

Binghamton, N. Y.—The contract for paving the new Rockbottom bridge with brick was awarded to A. L. Willey. The concrete work will be constructed by the Cement Products Company.

Milwaukee, Wis.—The contract for repairing the asphalt pavements on Wisconsin-st. and lower Grand-ave. was awarded April 14 to the Western Paving and Supply Company, at $1.75 a sq. yd.

Williamsport, Pa.—The contract for paving Franklin, Fifth, Hepburn and Willow-sts. has been awarded to Mayer Bros. of Erie, at $1.87 a sq. yd. Guise brick on six-inch concrete foundation will be used.

streets as follows: Laying brick, furnished by city, $1.15 a sq. yd.; macadamizing, 67½ cents a sq. yd.; curbing, 60 cents a ft.; excavation, 25 cents cu. yd.

South Bend, Ind.—Street improvement contracts hae been awarded as follows: Grades, curbs and walks on Sherman-ave., Siders Bros.; grades, curbs and walks on Stanfield and Main-sts., T. C. Barnes; cement curbs on Lindsey-st., Paul J. Haas.

Indianapolis, Ind.—The contract for paving Missouri-st. from Market-st. to Kentucky-ave. with brick has been awarded to J. K. Cooper & Sons, at $5.50 a sq. yd. J. H. Roberts secured contracts for cement walks on two streets at 60 and 63 cents a sq. ft.

Davenport, Ia.—Paving contracts were awarded April 19 as follows: Marquette-st., brick, Davenport Const. Co., grading 36 cents; paving, $1.68; curbing, 55 cents; paving number of streets and alleys with brick, People's Const. Co., $1.68 and $1.69.

Shreveport, La.—The city council awarded more contracts April 15 for paving as follows: Bitulithic, Louisiana-ave., Crockett and McNeil-sts. and Western-ave., Nashville Roofing & Paving Co., Nashville, Tenn.; brick, Southern-ave., Chatwin Bros., $2.15 a sq. yd.

Columbus, O.—Paving contracts were awarded April 18 as follows: Lexington-ave., A. G. Pugh, $2,443.80; part of Lexington-ave., Fisher & Knight, $1,682.95; McAllister-ave., D. E. Sullivan & Son, $1,616.85. Lexington and McAllister-aves. will be paved with Nelsonville blocks.

St. Louis, Mo.—The Granite Bituminous Paving Company secured the contract for paving Lindell boulevard, from Grand to Spring-aves., and from Spring-ave. to King's boulevard, with bitulithic pavement. The Barber Asphalt Paving Company was awarded the contract for paving Waterman-ave.; Fruin-Bambrick Construction Company, Duncan-ave.; M. Sullivan & Sons, Labadie-ave.

Scranton, Pa.—The contract for paving certain streets was awarded April 7 to the Barber Asphalt Paving Company, the only bidder, as follows: Paving Moir court, $2.56 a sq. yd.; keeping same in repair for five years, 10 cents a yd.; paving Forest court, $2.44½ a sq. yd.; Capouse-ave., $2.42 a sq. yd.

Ft. Wayne, Ind.—Bids were submitted April 7 for about 5 mis. of asphalt and brick paving. The Moellering Construction Company and Joseph Derheimer & Co., both of this city, were the only bid-

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ave., John Malcolm; Lapeer-ave. and Mccoskey and Second-sts., Z. & J. Lalonde; common macadam, limestone surface, P Crowley.

Chicago, Ill.—The R. F. Conway Co. was awarded a contract, April 15, for about $200,000 worth of asphalt paving. Farr Bros. were awarded the contract for paving Stewart-ave., from Sixty-third-st. to N. Normal Park, with granite-top macadam, for $20,000. The Panoch Sidewalk Co. submitted bids, April 21, for building cement sidewalks covering 360,000 square feet, at 12½, 13¼ and 14½ cents a square foot, which is 10 to 25 per cent lower than the average bids.

Shreveport, La.—Contracts were awarded, March 31, for street paving as follows: Bitulithic—Portions of Jacobs, Spring, Market, Caddo, Common, Cotton, Egan, Christian, Anna and Allen-sts., Nashvile Roofing & Paving Co., of Nashville. Brick—Portions of Commerce, Jones and Marshall. Nashville Roofing & Paving Co. Asphalt—Portions of Cotton, Marshal, Christian, Hope, Louisiana, Travis, Fairfield, Jordan, Edwards-sts., Memphis Asphalt & Paving Co., Memphis, Tenn.

Philadelphia, Pa.—Bids involving about $1,000,000 for asphalt paving were submitted April 22. Under previous specifications Bermudez Lake or Trinidad Lake asphalt only could be bid on, but under the new specifications the material is designated as the best quality of refined natural asphalt, and according to Director Costello, the term "natural" refers to that grade which is richest in bitumen and most free of organic and mineral matter. The bids for paving with the best natural or land asphalt were as follows: Filbert Paving & Construction Co., prices ranging from $1.83 to $2.11 a sq. yd.; W. S. P. Shields, $2.07; Barber Asphalt Paving Co., $2.14 to $2.21 a sq. yd; Lake asphalt—Barber Asphalt Paving Co., $2.14 to $2.21; Filbert Paving & Construction Co., $2.11; W. S. P. Shields, $2.07. Vitrified fire clay brick—McCormick & Co., $2.41 to $2.53; Thos. Cunningham, $2.19 to $2.37; M. J. Hagan & Co., $2.69 to $2.83; David McMahon, M. & J. B. McHugh, Joseph Glaretthy and Barber Asphalt Paving Co., at prices averaging $2.50 a sq. yd.

Rochester, N. Y.—Bids for street paving were submitted April 20 as follows:

Driving Park-ave. pavement—Estimate, $3,800; N. H. Cowles, $3,195; Preston brick, $3,147; Johnsonburg block, $3,387; Metropolitan block, $3,471.

Hebard-st. asphalt pavement—Estimate, $7,000; Rochester Vulcanite Pavement Company, $5,481; Whitmore, Rauber & Vicinus, $5,487; Barber Asphalt Company, $5,781; Rock Asphalt Company, $5,808.

Calumet-st. trap rock macadem pavement—Estimate, $6,500; Whitmore, Rauber & Vicinus, $4,309.10; H. B. Hooker & Son, $4,564.50; H. N. Cowles, $4,601.50; George W. Hagaman, $5,506; Thomas Holahan, $5,511; Brayer & Albaugh, $5,582.50.

Cortland, N. Y.—The contract for macadamizing Port Watson-st. from Lackawanna tracks to Port Watson bridge was awarded April 4, to R. W. Henderson of Geneva, for $21,427.50.

Atchison, Kas.—The contract for paving the roadway from the city limits to the Soldiers' Orphans' Home was awarded April 2 to McGuire & Stanton of Leavenworth for about $21,000.

SEWERS.

Sunnyside, Wash. — The Sunnyside Drainage Co. has been organized by S. J. Harrison, C. E. Woods, W. H. Cline, H. M. Lichty, Elza Deen, G. W. Reese and R. L. Reese. A drainage district is being organized according to the State law.

CONTEMPLATED WORK.

Pipestone, Minn.—A sewerage system is proposed.

West Point, Miss.—A sewerage system is contemplated.

Pullman, Wash.—A sewerage system is contemplated this year.

Elgin, Ill.—The construction of sewers is being discussed by council.

Yale, Mich.—This town voted, April 19, to construct a sewer on Main-st.

Angola, Ind.—The Magnet advocates the construction of a sewerage system.

Lowell, Mass.—Sewers are proposed for Forrest, Parker and Stevens-sts.

West Point, Miss.—The question of a sewerage system is being considered.

Milwaukee, Wis.—Bond ordinance will be introduced for flushing tunnel purposes.

Fairmount, Ill.—The citizens are agitating the question of building a sewerage system.

Hamilton, O.—Resolutions have been passed for constructing sewers on certain streets.

Franklin, Ind.—The cy. coun. voted, April 14, to build a general sanitary sewerage system.

Richmond, Ind.—Cy. Engr. Weber has submitted plans for a storm sewer in Northwest Second-st.

Boise, Idaho—Cy. Engr. Irwin has submitted his report for the proposed new sewer district.

Hyattsville, Md.—This city voted, April 8, to issue $30,000 for installing a sewerage system.

Marion, Ill.—Council is considering the question of issuing bonds for constructing a sewerage system.

West Duluth, Minn.—Common Council directed, April 11, that a sanitary sewerage system be constructed.

Claremont, N. H.—Plans for the proposed sewerage system will be made by E. Worthington of Boston.

Cape Girardeau, Mo.—Plans for a sewerage system will be made by Jackson & Omberg of Memphis, Tenn.

Cleveland, O.—The board of health adopted a resolution April 5 to establish a sewage reduction plant.

Barberton, O.—Ordinances were passed April 18 providing for the construction of storm sewers.

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Dyersburg, Tenn.—Surveys and plans are being made for a sewerage system by Granbery Jackson, of Nashville.

St. Paul, Minn.—Plans and estimates for building sewers in a number of streets have been filed by the city engineer.

Kansas City, Mo.—Plans for septic tanks to be located in the southeastern part of the city have been approved.

Waynetown, Ind.—Surveys for a sewerage system have been completed by Surveyor Harding and plans will be made at once.

Belding, Mich.—Special.—George W. Moulton, cy. clk., says that this city may build trunk, main and lateral sewers this year.

Havre de Grace, Md.—This city will vote May 2 on the question of issuing $20,000 bonds for building a sewerage system.

Ogden, Utah.—The question of issuing $55,000 bonds for constructing sewers will be voted on May 12. W. J. Critchlow, cy. recorder.

Lewistown, Pa.—An ordinance was passed April 22 submitting to vote the issue of $100,000 bonds to complete the sewerage system.

Hollidaysburg, Pa.—The street commissioner was directed, April 7, to engage a competent engineer to make grades for a sewerage system.

Cincinnati, O.—A resolution has been introduced to build a sewer in Strader-ave., from Humbert-st. to Eastern-ave., for surface water.

Bangor, Me.—The extension of the farm brook sewer, from Lincoln-st. northwesterly to Hammon-st., has been authorized by the council.

Butler, Pa.—An ordinance was approved, April 20, for constructing a main public sewer in this borough. Raymond S. Cornelius, prest. town coun.

Houston, Tex.—The question of issuing $650,000 bonds for constructing a complete sanitary and storm water sewerage system will be voted on June 27.

Marshall, Mo.—Special—Frank Watson, cy. engr., says that plans and specifications are being prepared for a system of sewers, approximating three miles.

Corning, Ia.—An ordinance was passed April 16 providing for the construction and control of sewers in this city. Carl Stanley, mayor; S. E. Day, cy. clk.

Covington, Ky.—Ordinances have been passed providing for the construction of sewers in a number of streets. George T. Beach, mayor; John J. Craig, cy. clk.

Akron, O.—Cy. Engr. Payne was directed, April 12, to prepare plans and specifications for a sewer to take care of sewage from the South Akron factories and residences.

Laurel, Miss.—(Special.)—The Iowa Engineering Company, Clinton, Ia., has been engaged to revise the sewer plans of this city and to superintend the construction, Church, Illinois, B, Spring and C-sts. with outlet sewer and septic tank, at a total cost of $88,662.19.

Mexico City, Mex.—R. C. Bateman has been engaged to make plans for a sewage purification plant for a small estate, capable of purifying the sewage created by about 1,500 persons.

Gorham, N. H.—A committee, with J. F. Libby as chairman, has been appointed to secure plans and estimates for a sewerage system and report at the next annual meeting in March, 1905.

Minneapolis, Minn.—The Council sewer committee decided, April 9, to build all large sewers of steel and concrete. Andrew Rinker, cy. engr., estimates that this will save the city $15,000.

Urbana, O.—A resolution was passed April 11 authorizing City Engineer Pratt to make a survey of the city for the purpose of ascertaining the cost of constructing a sewerage system.

Canastota, N. Y.—The Board of Trustees decided, April 11, to have a map of the sewers of this village prepared to facilitate the matter of constructing a new sewerage system.

St. Joseph, Mo.—(Special.)—W. B. Hazen, City Engineer, has been engaged to make surveys, plans and estimates for a levee and drainage of 10,500 acres of land between Des Moines and Fox river, at Alexandria, Mo.

Utica, N. Y.—An additional report on the sewer problem of this city has been submitted by George W. Rafter of Rochester, and among other things he recommends an expenditure of about $16,000 for a topographical map of the city and vicinity.

Whitinsville, Mass.—The estimated cost of a sewerage system for this town and Linwood, approximating about 10 1-8 miles of sewers, is about $95,000; filtration tanks, strainers and apparatus, $50,000. James Crichton and James R. Ferry are members of the committee.

CONTRACTS TO BE LET.

Marion, Ind—Sealed bids are asked until May 3 for constructing sewers. C. G. Robbins, cy. clk.

Marshfield, Wis.—Bids are asked until May 13 for a sewer on N. Central-ave. C. S. Vedder, cy. clk.

Park Rapids, Minn.—Bids are asked until May 6 for constructing ditch work. W. M. Kemerer, co. audt.

Cherryvale, Kas.—Sealed bids are asked until May 4 for building a sewerage system. S. J. Howard, cy. clk.

St. Bernard, O.—Sealed bids are asked until May 9 for building sewers in certain streets. Geo. Meyer, clk.

Los Angeles, Cal.—Sealed bids are asked until May 16 for 11.77 mls. of brick sewers. H. J. Leland, cy. clk.

Milwaukee, Wis.—Sealed bids are asked until May 8 for building sewers in the

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until May 5 for constructing state ditches. Peter E. Hanson, Secy. State.

Montgomery, Ala.—Bids are asked until May 2 for sewers in Jefferson, Davis and Holcombe-sts. R. S. Williams, cy. treas.

Owosso, Mich.—Sealed bids are asked until May 6 for building sewers, with manholes, flush tanks, etc. C. H. Cossitt, supt. B. P. W.

Watertown, Wis.—Sealed bids are asked until 4 p. m. May 7 for 700-ft. 8-in. sewers and 3 flush tanks. Geo. H. Stanchfield, chmn. B. P. W.

Moose Jaw, Assa.—Bids are asked until May 14 for sewerage work. W. A. Munns, secy-treas.; Willis Chipman, ch. engr., 103 Bay-st., Toronto.

Cannon Falls, Minn.—Sealed bids are asked until May 10 for constructing a sewerage system and septic tank. Geo. E. Wilson, vil. recorder.

Tamaqua, Pa.—Sealed bids are asked until 8 p. m. May 3 for building 13,500-ft. vitrified pipe sewers, with manholes, flush tanks, etc. W. F. Leopold, clk.

Charleston, S. C.—Sealed bids are asked until May 14 for constructing an extension of the 4-ft. brick intercepting drain. Mordecai T. Endicott, ch. bureau yd. and docks.

Coldwater, Mich.—Sealed bids are asked until May 9 for building 24, 20, 18, 15, 12 and 10-in. pipe sewers, 15 manholes and 23 drop manholes. A. A. Dorrance, prest. B. P. S.

South Bend, Ind.—Sealed bids are asked until 10 a. m. May 6 for 4,200-ft. brick sewer and 3,000-ft. pipe sewer; also 860-ft. of brick sewer in Madison-st. A. J. Hammond, cy. engr.

Washington, D. C.—Sealed bids are asked until May 7 for furnishing, delivering and erecting sewage screens, including machinery and apparatus complete at the sewage pumping station. H B. F. MacFarland, Chairman District Commissioners.

Chicago, Ill., Sealed bids are asked until June 7 for constructing a system of brick sewers 15-mis. in length, and constructing a sewage pumping station; also erecting four centrifugal pumping engines. A. M. Lynch, Chairman Board Local Improvements.

Butler, Ind.—Sealed bids are being asked until May 2, for constructing 41,775 feet of 60, 36, 30, 24, 18, 15, 12, 6 and 4-inch sewers, 60 manholes, 200 pipe-catch basins, 800 lot specials 35 lamp holes and 25 pipe-flushing holes. John H. W. Krontz, City Engineer.

Danville, Pa.—Bids are asked until May 12, for constructing a sewerage system, including boiler, pumps, reservoirs and all pipes and connections to install a broad irrigation system for disposal of sewage at the State Hospital for Insane. H. B. Meredith, Superintendent.

CONTRACTS AWARDED.

Middletown, Pa. — David Hatz was awarded the contract for a sewer on Pine-st. for $990.

Milwaukee, Wis.—The contract for building a brick sewer in Clinton-st. from Washington-ave. to Locust-st. was awarded to George E. Zimmerman, for $24,367.56.

Princeton, Ind.—The franchise for a new sewerage system has been granted to Alvy Levy.

Nashville, Tenn.—T. J. Mooney was awarded the contract for extending two c. i. sewer pipes, for $276.

Dubuque, Ia. — Noonan Bros. were awarded the contract for constructing a sewer in Dodge-st. for $4,395.75.

Des Moines, Ia.—O. P. Herrick was awarded the contract April 12 for a sewer in E. Seventh-st. at $1.04 a lin. ft.

Delray, Mich. — The contract for a sewer in McGregor-ave. was awarded to Langley & Jaynes of Detroit for $23,400.

Cincinnati, O.—The contract for a sewer in Woodburn-ave., from Fairfax to Dexter-aves., was awarded to McCarthy Bros.

Ashtabula, O. — N. J. Carlson was awarded the contract for sewers on Washington-st. and Tyler-ave. for $1,133.90.

Detroit, Mich.—D. J. Kennedy & Sons secured the contract for the sewer in McGregor-ave, Delray, April 19, for $21,250.

Edwardsville, Ill.—The contract for a sewerage system was awarded to Sweeney & Coonen of East St. Louis, for $15,088.37.

Kenton, O.—Evans & Childers secured the contract for building two sewers in the South Kenton sewer district, at 40 cents per foot.

Columbia, S. C.—The contract for sewerage work at the South Carolina College was awarded, April 23, to John T. Gaston for $1,675.

Columbus, Ind.—The contract for building a sewer in the north part of this city will be awarded to Stillinger & Co., for $9,244.50.

Oswego, N. Y.—The contract for sewers, drains and grading at the new post was awarded to C. A. Miner, of Wilmington, Del., for $17,849.

Memphis, Tenn.—The contract for constructing sewers in Lenox, a suburb, was awarded to Edwin Miller, of this city, for about $8,000.

Toledo, O.—O'Neil & Tansey secured the contract for building the Walbridge-st sewer and sewage reduction plant. for $21,412.20 and $1,011.20 respectively.

Birmingham, Ala.—The Jefferson County Sanitary Commission awarded the contract for constructing sections 6, 7, 8, 9 and 10 of the county trunk system to Black & Laird of Dallas, Tex., for $107,938.

Rockford, Ill.—Sewer contracts have been awarded as follows: Prairie and Eighth-sts., W. J. Allen, Waukegan; Eleventh-st., G. Maffioli, Rockford; Benton and N. Second-st. and Eleventh and Fourteenth-aves., E. S. Gregory.

Dolgeville, N. Y.—The contract for constructing a sewerage system was awarded, April 8, to Nicolette & Harder of Potsdam for $33,472 and disposal works to Waldie & Snyder of this city for $7,427.

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York, Pa.—Sewer contracts were awarded, March 28, as follows: Contract "A," Smith Const. Co. of Philadelphia, $186,387.79; contract "B," Geo. W. Ruch & Co. of Philadelphia, $268,804.16. Contract "C" was held over.

Mt. Clemens, Mich.—Chas. S. Ferrin has been awarded the contract for sewers in Jones-st. and Maple-ave. for $873. The contract for a sewer in Church-st. was awarded to W. W. Hatch of Goshen, Ind. at $8.44 a lin. ft

Menominee, Mich.—John Sanderson of Marinette, Wis., was awarded the contract for constructing sewers as follows: Maud-st., $496.80; Marinette-ave., $865.52; Baker-ave., $776; Williams-ave., $1,243.22; Parmenter-st., $914; total, $4,295.54.

Rochester, N. Y.—Bids for sewers were submitted, April 18, as follows: Norton-st. grading and sewer: Estimate, $3,600; Ripton & Murphy, $3,285; H. B. Hooker & Son, $3,479; Brayer & Albaugh, $7,002.50.

Jackson-st. sewer—Estimate, $2,800; Bert Bauer, $1,817; John J. Regan, $1,850.50; H. N. Cowles, $1,868; John Colman, $1,878.60; Crahan & Kearns, $1,903.10; F. A. Brotsch, $2,203; Thomas Holahan, $2,337.50; H. B. Hooker & Son, $2,370; Brayer & Albaugh, $2,520.90; Ripton & Murphy, $2,560.

Bernard-st. sewer—Estimate, $1,800; Bert Bauer, $1,259.25; Crahan & Kearns, $1,493.50; John Calnan, $1,599.25; Thomas Holahan, $1,641; John J. Regan, $1,671; Brayer & Albaugh, $1,694.25; Ripton & Murphy, $1,709; H. N. Cowles, $1,711.

Hollenbeck-st. sewer—Estimate, $600; John J. Regan, $381.50; Bert Bauer, $389.95 (informal); John Calnan, $399.90; Crahan & Kearns, $420.75; Ripton & Murphy, $475.75; Thomas Holahan, $654.

WATER-WORKS.

CONTEMPLATED WORK.

Boise, Idaho.—A gravity w. w. sys. is advocated.

Ft. Mills, S. C.—The installation of a w. w. sys. is proposed.

Lehi, Utah.—The feasibility of establishing w. w. sys. is being considered.

Lima, O.—The question of a new water works reservoir is being investigated.

Winfield, Kas.—This city voted to install w. w. and electric light systems.

Warner, N. H.—This town voted to make an appropriation for water main extensions.

Walla Walla, Wash.—The question of building a gravity w. w. system will be voted on.

Oklahoma City, Okla.—Council contemplates providing for improvements to the been made by C. M. Thorpe, City Engineer.

Taylor, Tex.—About $15,000 will be expended in placing larger water mains along the business streets.

Auburn, N. Y.—Application for four or five miles of water main extensions have been made to the water department.

Belding, Mich.—Special.—Geo. W. Moulton, City Clerk, says a franchise will be let for a complete water works system.

Westfield, Mass.—A preliminary survey for a storage reservoir in connection with the Granville system, will be made.

Island Falls, Me.—A water system will be installed and John E. Webb desires prices of supplies, apparatus, etc.

Sacramento, Cal.—The estimated cost of a city water main on I-st. from Front to Ninth, is $17,000. J. C. Pierson, City Engineer.

Gorman, N. H.—J. F. Libbey is chairman of a committee appointed to secure plans and estimates for a water works system, to report at the next annual meeting in March, 1905.

The question of issuing water works bonds has been favorably voted on at the following places: West Gate, Ia.; Houston, Minn.; Walnut Grove, Minn.; Waverly, Neb.; Brooklyn, S. D.

The question of issuing bonds for construction water works will be voted on at the following places: Idaho Springs, Colo., June 14; Findlay, Ill.; Portage La Prairie, Man., May 2; Pepin, Wis.

Wilmington, Del.—A supplementary report on the proposed new water plant for this city has been submitted by City Engineer Leisen, who favors Rockland as a source of supply. The estimated cost of the plant is $750,000.

Bozeman, Mont. — (Special.) — C. M. Thorpe, County Supervisor, says the City Council is about to advertise for bids for about three and a half miles of fourteen-inch wooden pipe, and he has been directed to draft specifications for this work.

The construction of water works systems is contemplated at the following places: Garden Plain, Kas.; Fountain, Colo.; McKenzie, Tenn.; Manson, Ia.; Ellicott City, Md.; Brewster, Minn.; Basin, Mont.; Bristol, S. D.; Comfrey, Minn.; Hancock, Minn.; Java, S. D.

CONTRACTS TO BE LET.

Corning, Cal.—A franchise for furnishing water for a term of fifty years will be let May 5.

Port Huron, Mich.—Bids are asked until May 6 for the completion of the canal from Lake Huron to Black River.

East Orange, N. J.—Bids are asked until May 9 for a brick engine and boiler house,

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South St. Paul, Minn.—Bids are asked until May 16 for laying 1,700 ft. of water mains. C. W. Clark, cy. recorder.

Lynchburg, Va.—Sealed bids are asked until May 16 for a gravity water supply. William V. Wilson, chm. com. on water.

Waterbury, Conn.—Sealed bids are asked until 7:30 p. m. May 3 for laying water mains in certain streets. R. A. Cairns, cy. engr.

Indianapolis, Ind.—Sealed bids are asked until May 2 for constructing a concrete steel or a steel aqueduct. Indianapolis Water Company.

Saugatuck, Mich.—Sealed bids are asked until May 5 for constructing a water works system. J. H. Pear, Prest. village bd. trustees.

Cannon Falls, Minn.—Bids are asked until May 10 for extending water mains and erecting a pumping station. George E. Wilson, vil. recorder.

Marietta, O.—Sealed bids are asked until May 3 for improving the water system by wells in the river or by filtration. John H. Riley, prest. B. P. S.

New Orleans, La.—Sealed bids are asked until May 10 for furnishing two gasoline engines, two centrifugal pumps and two centrifugal pumps with motors. F. S. Shields, secy. sewerage bd.

Cincinnati, O.—Bids are asked until May 3 for cast iron pipe and special castings for water mains required for extension and betterment of the water distribution system. August Herrmann, prest. bd. trustees.

Jacksonville, Fla.—Bids are asked until May 4 for furnishing f. o. b. cars 1,500 K. W. turbo-generator, with exciter and switch panels, turbine to be worked condensing at 150 lbs. steam pressure, 27-in vacuum; generator to be 3-phase, 60-cycle 2,300 volts. R. N. Ellis, supt. bd. trustees.

Columbus, O.—Sealed bids are asked until May 11 for constructing a concrete masonry dam consisting of 7,000 cu. yds. dry earth excа., 6,000 cu. yds. wet earth excа., 15,000 cu. yds. rock excа. and 56,200 cu. yds. concrete masonry. Charles H. Frank, Sec. B. P. S.

CONTRACTS AWARDED.

Harrisburg, Pa.—The contract for a filtration plant was awarded April 18 to Coder & Miller of this city for $275,000.

Carthage, Mo.—The contract for erecting a filter and new building for pumping station was awarded April 6 to McNerney Bros. of this city for about $15,000.

Toledo, O.—The M. Rabbit & Sons Company secured the contract for furnishing pipes, specials, etc., and laying submerged 20-inch water main from Water-st., on Walnut-st., to point in Main-st., for $17,600.

Kennedy Heights, O.—The contract for laying mains, setting valves, hydrants, etc., was awarded April 9 to Frank Burns of Cincinnati for $2,265. The U. S. Cast Iron Pipe & Foundry Company was awarded the contract for furnishing pipe for $4,513.

BRIDGES.

Wapakoneta, O.—Bids are asked until May 4 for building two steel bridges. Board County Commissioners.

Columbus, Ga.—Bids will be opened May 6 for building two steel bridges over Wolf Creek.

Olathe, Kans.—Bids are asked until May 4 for building five steel bridges. J. G. Rudy, County Clerk.

Albion, Ind.—Bids will be received May 3 for building several bridges. D. L. Henry, County Auditor.

Indianapolis, Ind.—Bids are asked until May 2 for building ten steel bridges. C. J. Clark. County Auditor.

Waynetown, Ind.—The Commissioners of Montgomery and Fountain counties decided, April 11, to build a bridge over Coal creek.

Frankfort, Ind.—Bids are asked until May 7 for a sixteen ft. concrete arch bridge. Wm. H. Armatrot, chm. co. comrs.

Fullerton, Neb.—Bids are asked until May 12 for a steel highway bridge over Loupe river, S. Stevenson, County Clerk.

Huntington, Ind.—Bids are asked until May 10 for constructing steel floor system in a number of bridges. George F. Morris, County Auditor.

South Bend, Ind.—Bids are asked until May 21 for building one steel bridge and one concrete arch culvert. John W. Harbou, County Auditor.

Bridgeport, Conn.—Plans and bids will be received May 7 for constructing a steel bridge with abutments. H. G. Scofield, City Surveyor.

Paoli, Ind.—Bids are asked until May 5 for building one steel bridge, one wooden bridge and two steel floor systems. Geo. W. Teegarden, co. audt.

Youngstown, O.—Bids are asked until May 10 for the restoration and construction of the sub-structure of a bridge. W. R. Leonard, co. audt.

Elwood, Ind.—The city officials are considering the construction of concrete arches over Duck creek at the points where old bridges were washed away.

Greensburg, Ind.—The contract for a steel bridge across Black Rock river, near Downeyville, was awarded to the Converse Bridge Company of Chattanooga, Tenn., for $2,295.

Bangor, Me.—Committees have been appointed to consider the matter of a new bridge across Kenduskeag stream, and will report to cy. coun. by May 12. P. H. Coombs, cy. engr.

Grenada, Miss.—Bids are asked until May 3 for a steel or wood bridge over Turn Bull creek and for steel approaches to Logan Bridge in Dist. No. 1. J. S. King, chancery clk.

Port Huron, Mich.—Bids are asked until May 6 for the uncompleted portion of the canal from Lake Huron to Black River, including canal, bridges, water ways and pier. R. D. O'Keefe, supt. pub. wks.

Toledo, O.—Sealed bids will be received until May 3 for building superstructures of

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a bridge over Maumee River at Grand Rapids, O., and one at Waterville, O. David T. Daves, Jr., co. audt.

Indianapolis, Ind.—The iron bridges over Goose Creek at West Newton, over Fall Creek at Thirtieth-st. and over Fall Creek near Fair Grounds will be sold at public auction June 14. C. J. Clark, co. audt.

PARKS.

Rockford, Ill.—The Rood property has been leased for park purposes.

Red Wing, Minn.—Special.—A park on the river front is contemplated.

Nauvoo, Ill.—The question of issuing $15,000 park bonds will be voted on.

Somerville, Ga.—Property on Telfair-st. has been presented to this village for park purposes.

Fall River, Mass.—The plans of Olmstead Bros. for the improvement of North Park have been adopted.

Columbus, O.—The C. D. & M. Traction Co. has purchased a park site along its line three miles north of Prospect.

Rome, Ga.—The conversion of the district along the W. & A. R. R. from Second-ave. to the old water works into a city park is contemplated.

Belfast, Me.—The purchase of land on the shore, with suitable shore privileges for use as a public park, is urged by the Belfast Improvement Society.

New York City.—Mayor Mc Clellan has appointed a commission on beautification, and the Board of Aldermen has appropriated $15,000 for the use of the commission. Daniel S. Lamont, chairman commission.

STREET LIGHTING.

Eau Claire, Wis.—Mayor Rowe is in favor of a municipal light plant.

McKinney, Tex. — The question of a municipal electric light plant is being agitated.

Burlington, Wis. — The electric light commission has reported in favor of a municipal light plant.

Milwaukee, Wis.—A municipal light plant is favored and resolutions providing for the issue of $150,000 bonds have been introduced.

Traverse City, Mich.—Bids are asked until May 31 for lighting streets and alleys for five years. Charles M. Vere, Cy. Clk.

[illegible] N. W. T. Bids are asked till May 16 for an electric light plant. John H. Chaffin, prest. bd. trustees.

Fennimore, Wis.—Trustees Edge, Blanckard & Ructi have been appointed a committee to investigate street lighting.

Effingham, Ill.—Bids are asked until May 17 for lighting streets in this city for 5, 10 and 15 years. J. F. Johnson, cy. clk.

Chicago, Ill.—Sealed bids are asked until May 3 for 50,000 feet of electric light cable and 6,000 feet fire alarm cable. Cy. electrician.

The question of issuing electric light bonds has been favorably voted on at the following places: Eaton Rapids, Mich.; Bellingham, Wash.; Thomasville, Ga.; Flora, Ind.; Winfield, Kas.; Newstrand, Minn.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Findlay, O.—Bids for removing garbage will be received on May 9.

Sacramento, Cal.—The Board of Health urges the erection of a garbage crematory.

Cleveland, O.—Bids are asked until May 2 for ten street flushing machines. A. R. Callow, secretary B. P. S.

Dayton, O.—Sealed bids are asked until May 3 for sprinkling certain streets. William F. Miller, clerk B. P. S.

Lansing, Mich.—The contract for the collection of garbage for five years has been awarded to the Lansing Garbage Company.

McKeesport, Pa.—Sealed bids are asked until May 4 for the erection of a garbage furnace. C. E. Soles, cy. compt.

St. Louis, Mo.—A temporary garbage contract has been awarded to the St. Louis Sanitary Company for $10,833.34 a month.

Pittsburg, Pa.—The public safety com. has recommended a contract with the American Reduction Company for the removal of garbage at $155,000 per year.

Indianapolis, Ind.—Contracts for sprinkling the unimproved streets of this city have been awarded to R. Thomas & Co., H. T. Nolting, H. W. Miller and Reeder & Newby.

Wilmington, Del.—City Council decided April 19 to make an investigation of the collection of garbage with a view to ascertaining whether or not the contractors have lived up to their contract.

Brooklyn, N. Y.—Bids are asked until May 5 for furnishing and delivering 200 combination can and bag carriers. Bids [illegible] also be received by John MacG

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MUNICIPAL ENGINEERING

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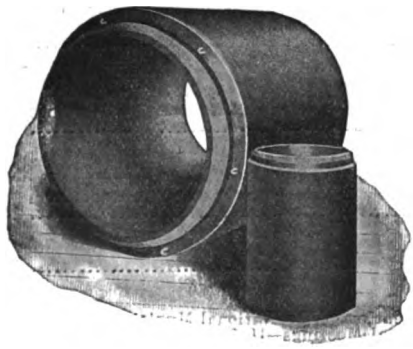

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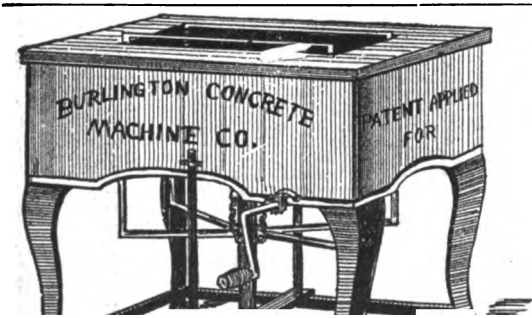

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Fisher Hydraulic Stone Co., Memphis, Tenn.
Forter-Miller Engineering Co., Pittsburgh, Pa.
Goshen Cement Block & Post Co., Goshen, Ind.
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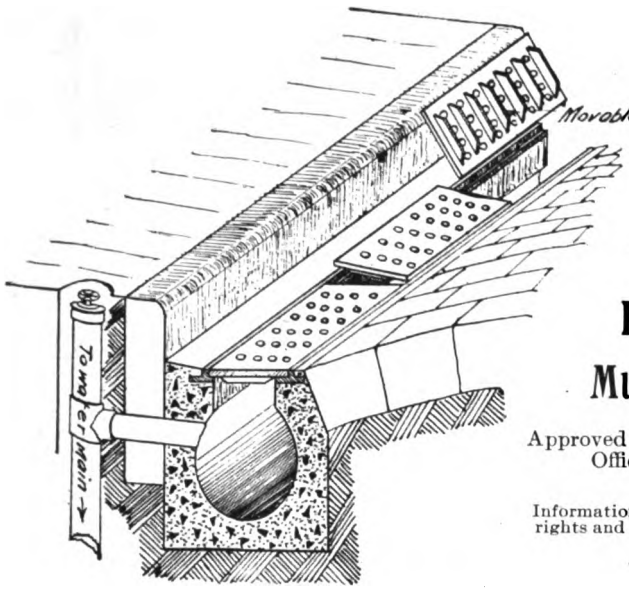

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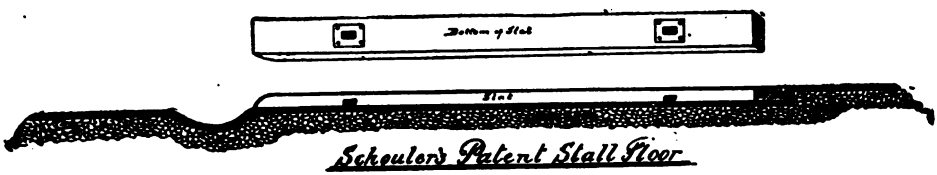

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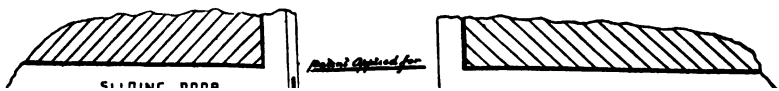

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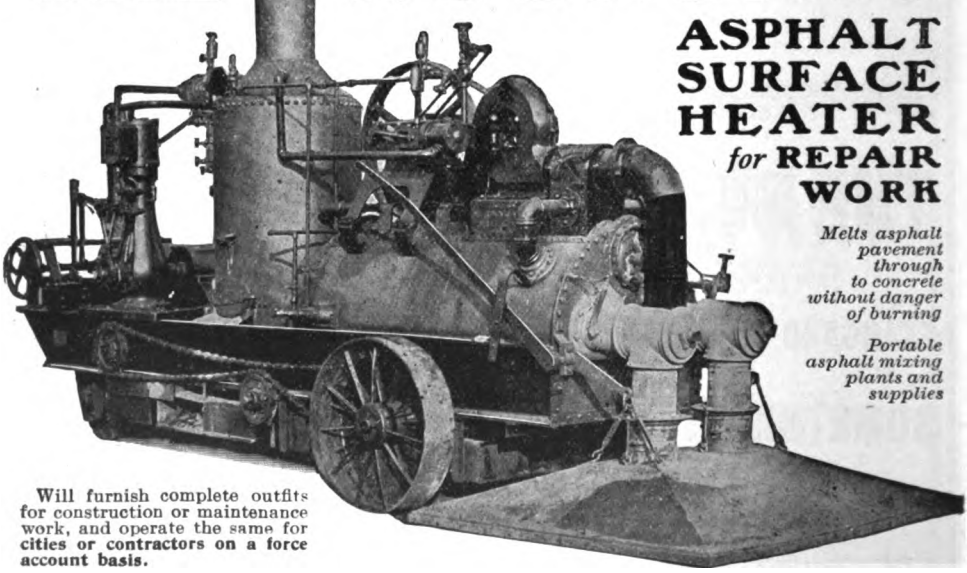

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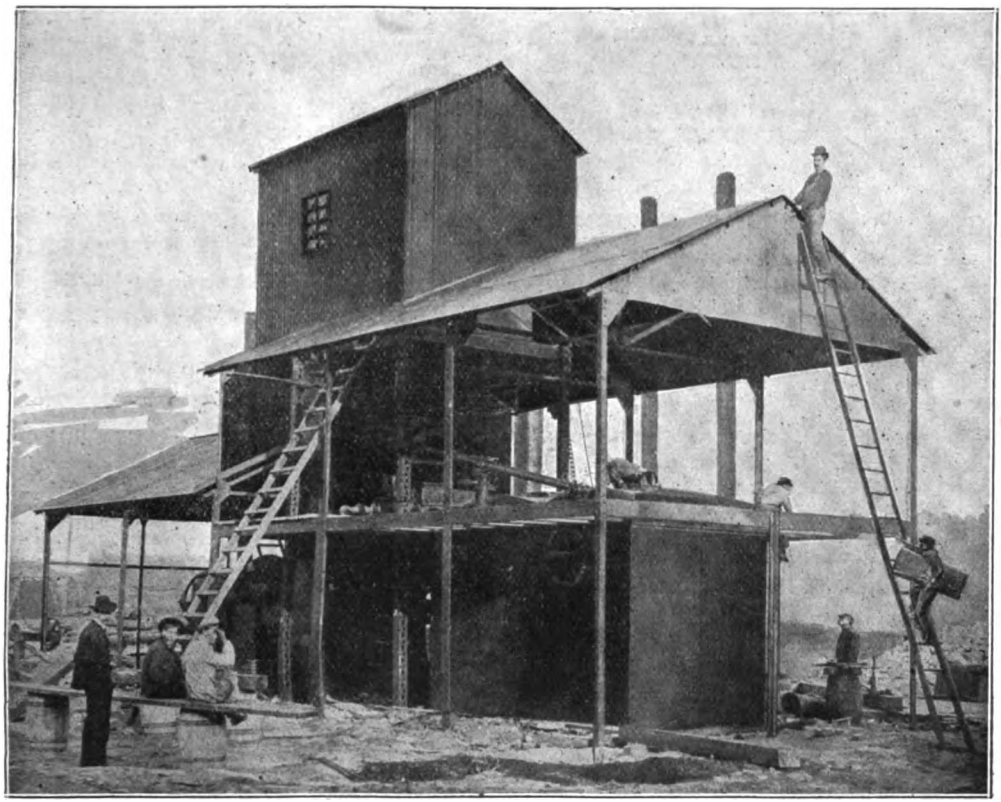

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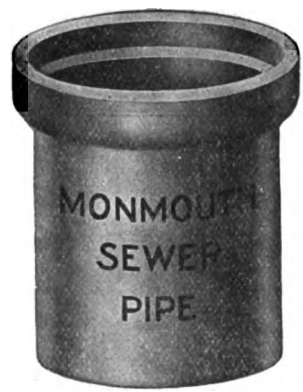

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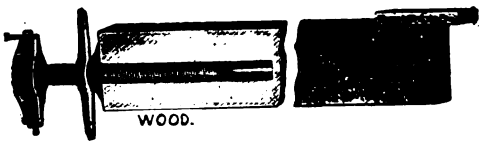

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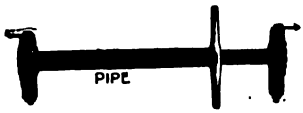

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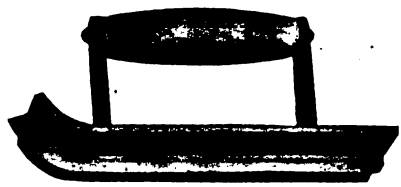

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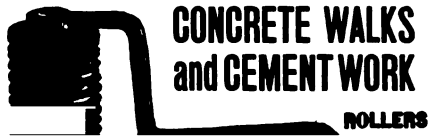

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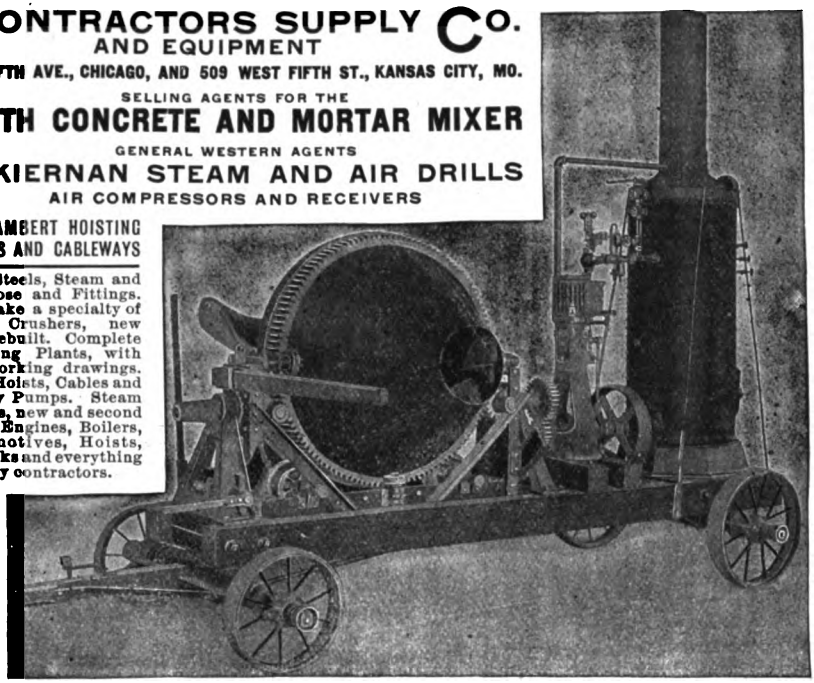
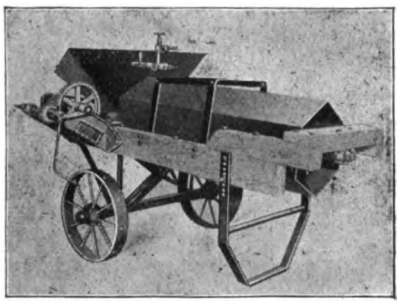


No. 2 on Truck with Steam Engine & Boiler



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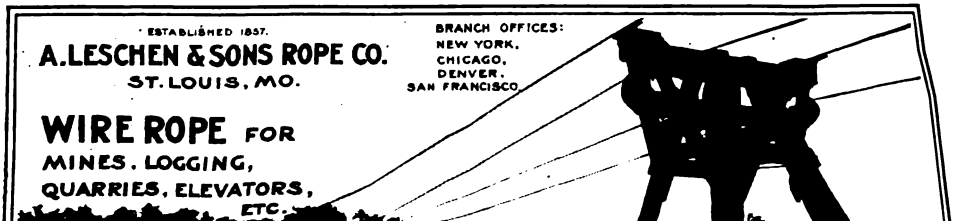

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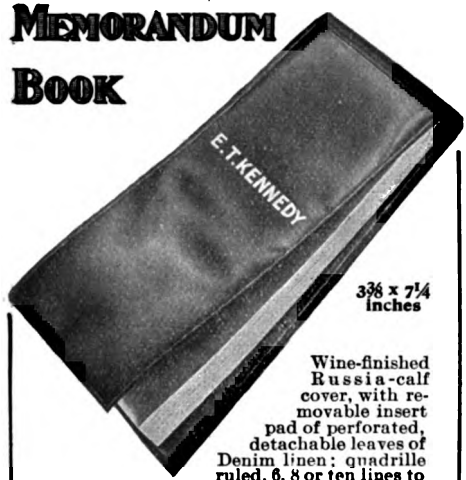

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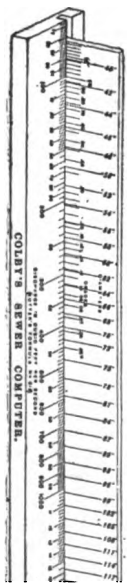

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Colby's Sewer Computer gives correct results according to Kutter's formula. It is accurate and perfect in every respect. It is 21 inches long and weighs a few ounces. Full directions with each computer.

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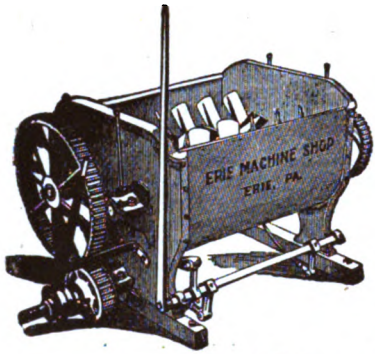

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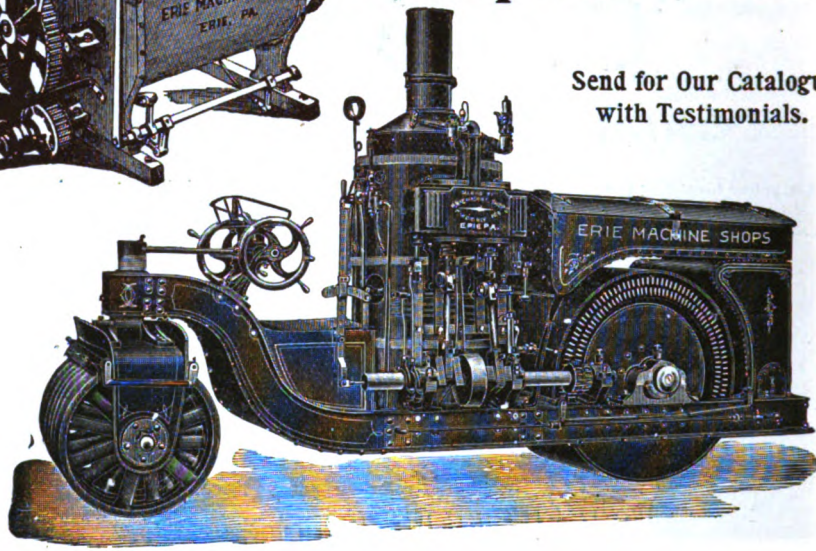

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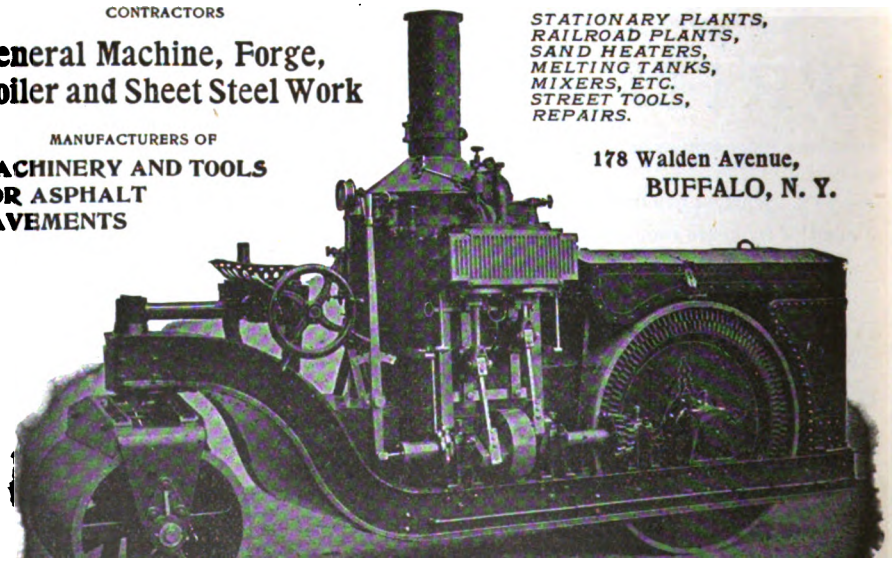

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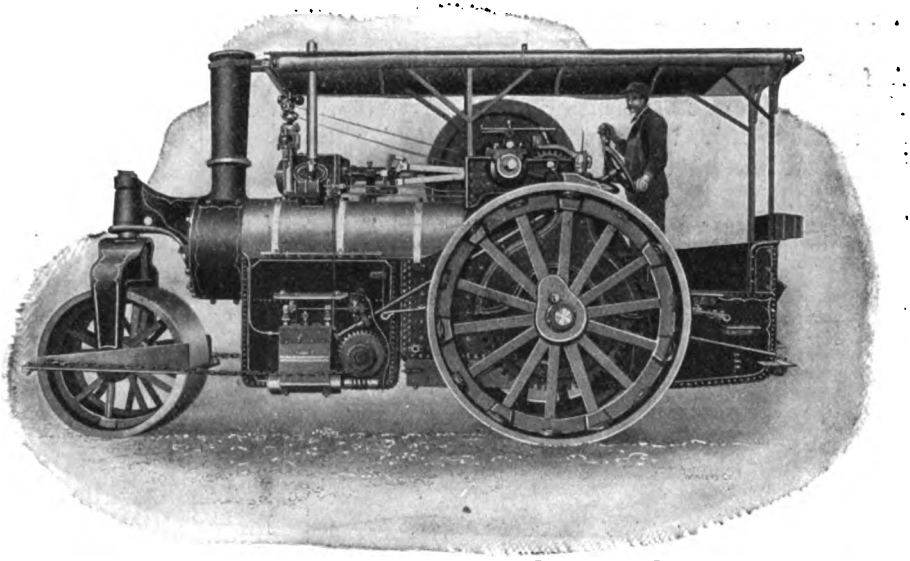

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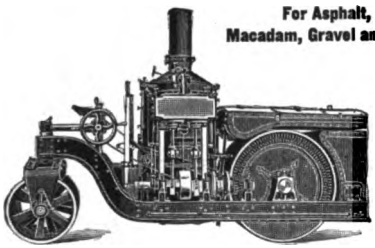

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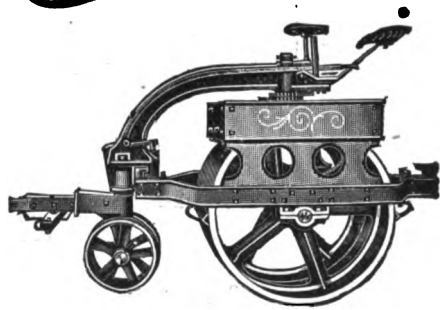

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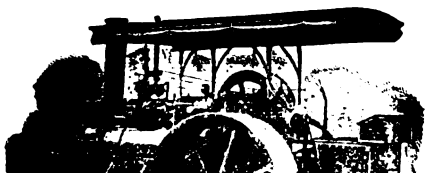

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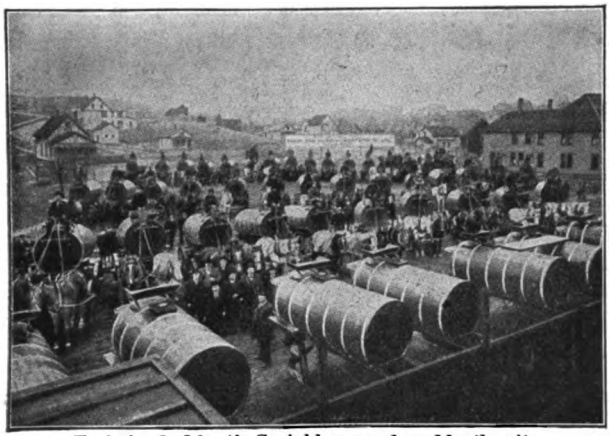
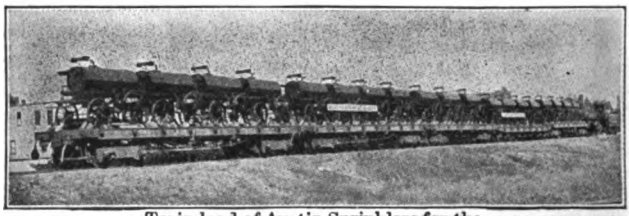
A few years ago we were selling AUSTIN SPRINKLERS by carloads. Now they go out by train-loads. Some of these train-load purchasers are: The United States Government, for use in the city of Washington, the cleanest city in America, which is swept and sprinkled by AUSTIN SWEEPERS and SPRINKLERS; and for Yellowstone Park, the greatest park in the world, in which AUSTIN SPRINKLERS are used almost exclusively.



Train-load of Austin Sprinklers purchased by the city of St. Paul—the largest single shipment of Sprinklers ever made by any one Company

Greater New York gets a train-load every now and then, while all the large cities are continually buying them either in train-loads or numerous carloads.



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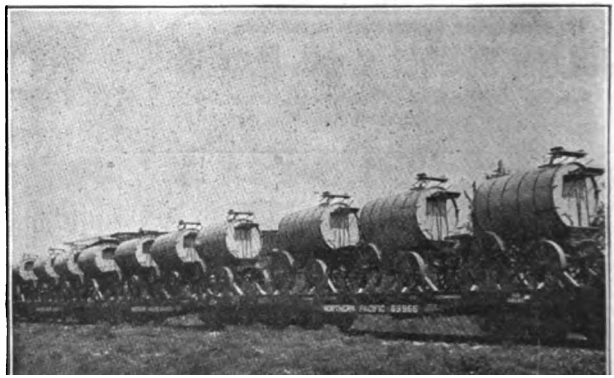

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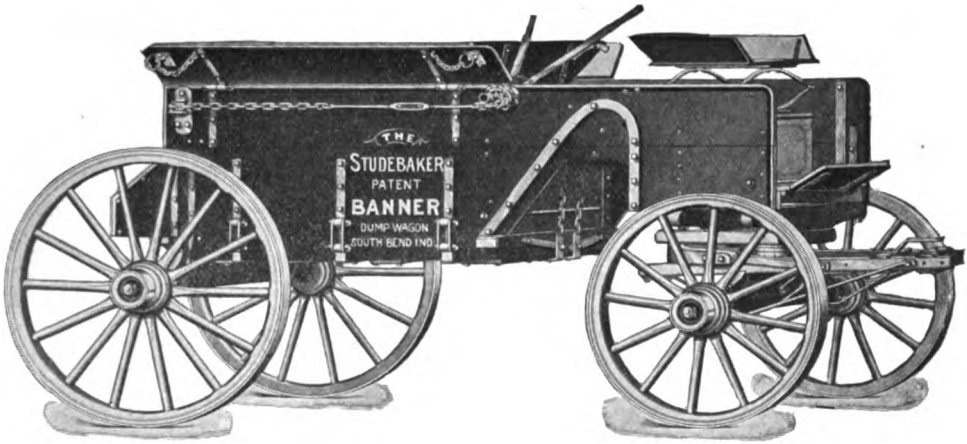
STUDEBAKER "BANNER" DUMP WAGON



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The inside of bed is square, smooth and clear of any obstruction. The trap doors underneath are operated by a lever and pulley, the mechanism being all on the outside of bed. When the doors are released or opened, they are automatically lifted out of the way, and the load is dumped clean. Another lever operates to fix the doors at any desired opening, making this wagon especially adapted to distributing crushed stone or other paving material over any given surface. We build sprinkling wagons, street sweepers, contractor's wagons and carts of all descriptions. Also harness for every purpose. Catalogs and prices on application. **The Studebaker reputation and guarantee back of every purchase.**

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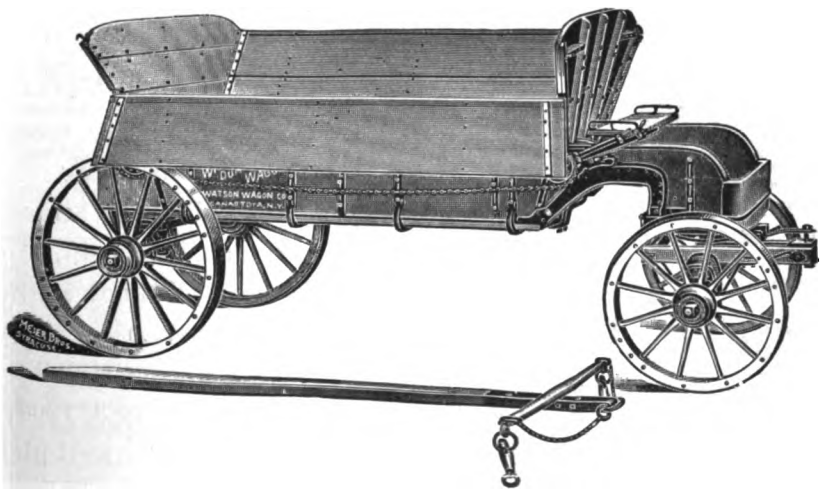

They are dumped instantly, by a mere touch, and closed without stopping the team.

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WITH VERTICAL SPRINKLING HEADS AND PATENT SPRAY REDUCER

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Each head operates independently, and affords any width of spray or desired volume of water, at will of driver.

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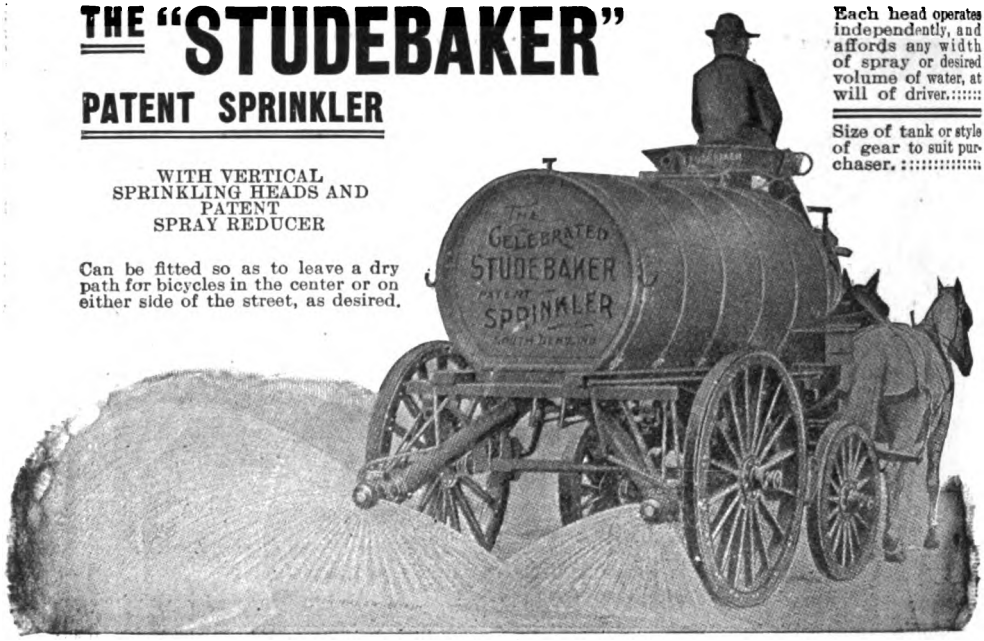

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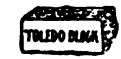

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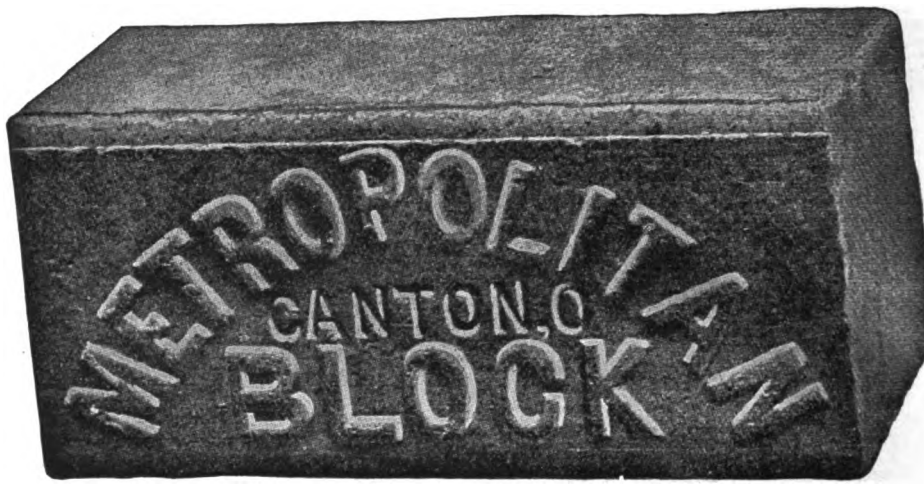

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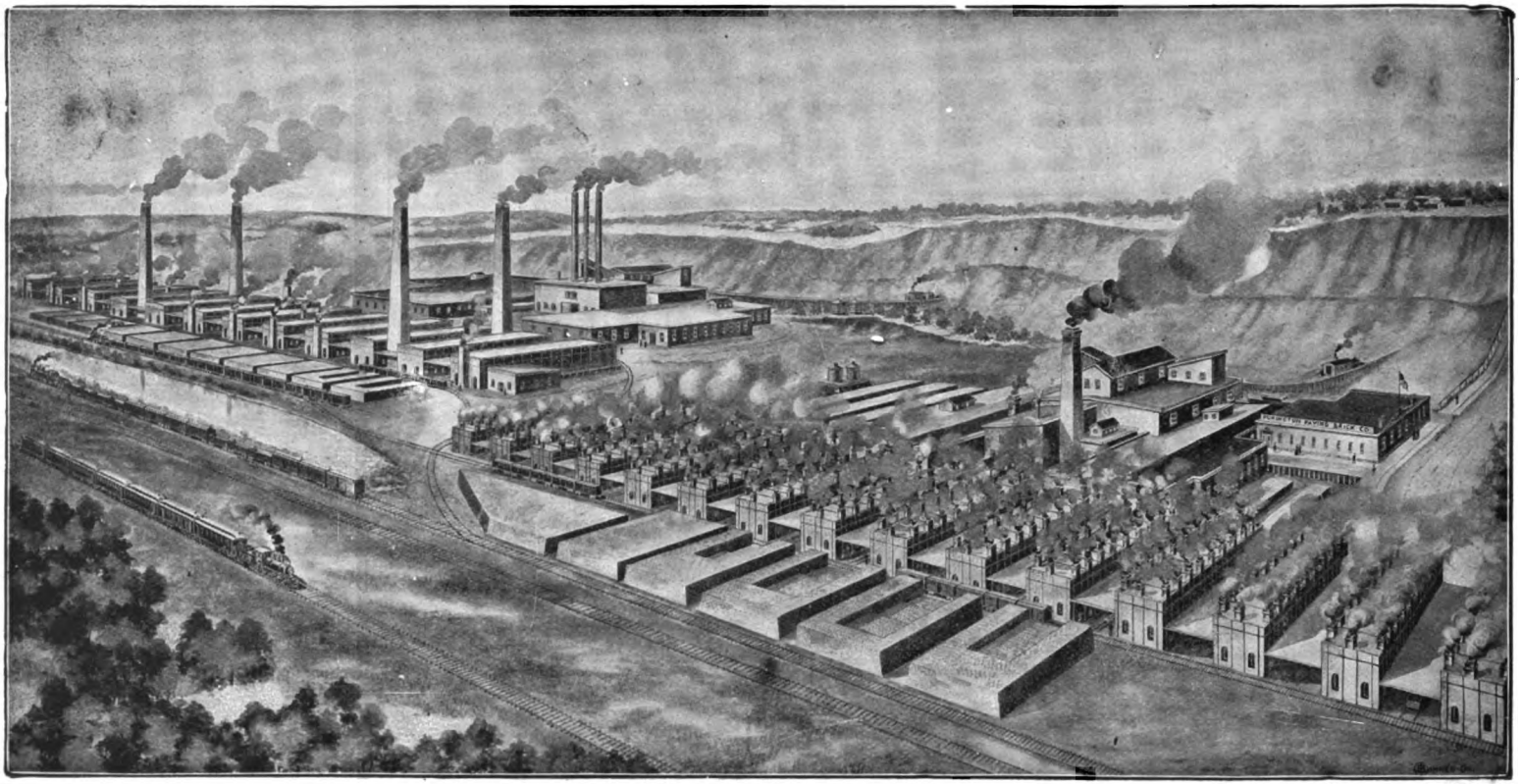

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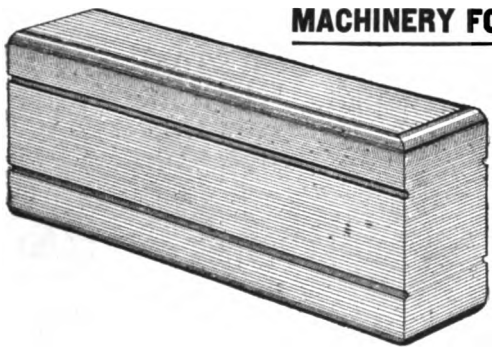

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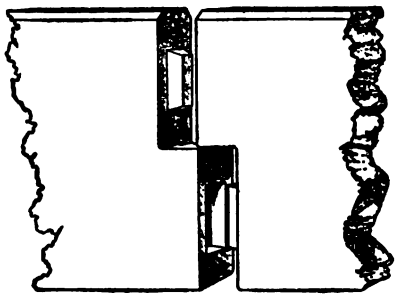

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MUNICIPAL ENGINEERING

VOLUME XXVI JUNE, NINETEEN HUNDRED FOUR NUMBER SIX

CONCRETE BLOCK MANUFACTURE.

The frequent requests for information about the manufacture of concrete blocks and artificial stone, and the choice of machines and processes for the same, call for some consideration of the underlying principles which should govern the development of a business proposition of this sort, and which are almost always neglected, with unfavorable effect upon public opinion regarding this new and valuable method of building construction.

There are three principal factors to be considered in setting up an artificial stone business, quality, quantity and cost, and each step in the process must be considered with these three factors always in view.

Quality depends first of all upon the materials used and the methods of putting them together. As stated more in detail in the article on "Concrete Block Architecture," on page 313 of the May number of Municipal Engineering, comparatively little attention is paid to this important feature by the ordinary purchaser of a cement block machine and as a consequence complaints of blocks defective in form, strength or appearance are beginning to be heard. These defects are in no way to be explained except on the score of ignorance of the qualities of cement and of the methods of manipulating it properly. The first requisite, therefore, of a successful artificial stone business is knowledge of the materials to be used and of the proper methods of putting them together. Much valuable information can be obtained from the manufacturers of machines, but the best information is that which comes from experience. Many of the machines on the market are good machines, but the best machine is not necessarily the most expensive one. Some of the cheaper machines are capable of producing excellent blocks, and the best machine is the one which will produce the best blocks for the least money.

The methods of manipulating the concrete vary according to the requirements of the case, provided the strength of the blocks is not affected. It may therefore be possible to make blocks of materials producing less satisfactory surfaces, or to make them with less attention to external surfaces and therefore more rapidly, if they are to be used in foundations than if they are to be used in face work or for trimmings. Quality in form and appearance is therefore a relative matter. Too many who are beginning the manufacture of concrete blocks fail to recognize this and offer the same blocks for all uses. They thus lose the work which they put on making a fine finish for a block to go underground, or, what is much more frequently the case, they offer for face work a block which is only fit in appearance and durability of surface for foundation work, and so discredit all concrete block construction, cutting off all hopes of future fine work.

The quantity of work to be turned out is an important factor in the choice of machines. The mixing of the concrete forming the body of the blocks is practically the same for all purposes which they may be made to serve. The cheaper blocks can be made rapidly and the machine which will handle them the most rapidly and permit their removal to the curing shed the most quickly will be the most satisfactory one to use. There is considerable difference in the number of men required, and in the amount of mechanical power, if any, and there is

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change to make many kinds and forms of blocks and stones, may be the most desirable, while it may very well be true that in a large business each machine may be restricted to a very small number of different forms and the number of different machines may be increased in order to supply all the demands that may arise. Some cement block makers have found it advisable to use machines of several different makes and designs, rather than to restrict themselves to one type.

The question of wet or dry process, of molds or machines, also comes up for decision. Each process has its strong adherents, and each doubtless has its field in which it is best, but both can be employed for all the uses of either.

The blocks for face work, for trimmings, lintels, window casings, ornamental structures, steps, balustrades, and other architectural features require more attention to the formation of the external surfaces and speed of operation must be a secondary matter. The principal objects, after strength is provided, are to make a handsome surface and to make it durable, so that cracks will not form and the surface will not rub off. Many cement block makers use a mixture for the surface of fine blocks different from that used in the body of the block. This introduces an additional process concerning which there is much lack of knowledge, and in such cases the result is complaint of defective workmanship. It also increases the time needed for making a block. The cost is increased by both extra labor and extra material.

The effect of machines, number of pallets or molds, number of men, their expertness and that of their superintendents, materials, quality and quantity of product, etc., on the cost of blocks is not easy to compute.

But after quality of materials and product have had their share of attention, cost of blocks is the most important factor in the choice of a machine. However, cheapness of product has been emphasized so much that it has overbalanced some considerations of equal importance in the question of cost.

Where good sand, gravel and cement are cheap and blocks are made with reasonable speed of operation of machines, good blocks for any purpose except the finest finish and trimmings can be made and put in place in a wall at a price to compete with common brick, such as would not be used for facing a wall in a similar location. This fact has been made the most of, and new firms, ignorant of the effect of increase in price of cement and labor, and of reduction in speed of making blocks upon their cost, have tried to procure the same result. Lack of expertness in running the machine, lack of executive ability of managers, greater cost of materials, have often prevented a favorable outcome, and too often the necessary competitive price has been made possible by reducing the cost of manufacture below a safe limit, with the serious results noted above.

Even with high prices for materials and labor, it is almost always possible to make a foundation block and put it in place as cheaply as brick suitable for the same use. But when blocks are to be made for external walls it must be remembered that they come into competition with face brick, both in appearance and durability and in cost. It is possible, then to take the extra care which is necessary to give the blocks their best external appearance and still to compete in price with the better qualities of brick which are met. Here is where the errors are made most frequently in the block business. The monotony of a single pattern of rock face, the artificiality of any imitation of rock face, the ignorance of the strength and durability of good concrete, the inertia of architects, all tempt the block maker to get a start by making his great point on the cheapness of the construction and then, from ignorance or business necessity, the blocks are made too cheaply. The blocks are seldom used under these conditions except in the cheaper buildings, built probably without the advice of an architect. The cheap blocks have the disadvantages named and sometimes develop in addition defective surfaces, the mixture or surface finish not being properly made. As a consequence, the structures in which the blocks have been used do not serve the desired purpose of advertisements, but rather restrict the future use of the blocks to even cheaper structures, if not to foundations only.

The artificial stone blocks can enter into competition with cut stone for trimmings, casings, rails, balustrades and the like for nearly all classes of buildings, but to do so cheapness of construction must be lost sight of. With the best materials, the most expert workmanship and the greatest time necessary, the artificial stone is so far in cost from cut stone that it is worth while to put upon it all the expense necessary to insure the best possible results. This is seldom done by block makers, and, consequently,

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fine work of this class is conspicuous by its rarity.

The true principle upon which to base a campaign for the introduction of artificial stone in a locality is to try for the best work which offers, to conform to the requirements of the really good architects and to make the fight first on the ground of strength and beauty of material and second on the basis of the great saving in expense. If the first points can be made clear the last will greatly aid in securing the specification of the material. Such a plan requires knowledge of the structural and architectural possibilities of concrete and artificial stone such as few of the purchasers of block machines possess. This brings us back to the statement with which this article begins, that the first requisite for a successful concrete block business is a knowledge of the material and its uses.

The competition for the cheaper work can be entered upon after the best class of work has been established, and it will then be overcome so much the more easily because the quality of the work has been proved to be unexceptional, and the price need not then be cut to the danger limit in order to get a hearing. A little more capital and much more knowledge is needed at the beginning, but the final result is certain to be much more satisfactory from every point of view, and especially on the financial side.

It is not possible to make a selection on general principles from among the many excellent machines and processes on the market, for local requirements of materials, men, knowledge of the business, class of trade which can be secured, present prospects for business, possibilities of rapid future growth, etc., will swing the decision for or against certain machines or classes of machines and processes, and may often lead to the use of more than one kind of machine or more than one process. Undoubtedly there are differences in efficiency of the same general type as well as of the various types, but they are so connected with the personal preferences of the operators that one who is not familiar with all the machines by use must make his choice as best he can for his special requirements. If the principles on which the business should be conducted will aid in any way in making this choice this article will have achieved one of its purposes. Perhaps it will aid also in lifting the artificial stone business to the higher level, artistically and as a business proposition, to which it is entitled.

COST OF BUILDING AND OPERATING A PORTLAND CEMENT PLANT.

By Boilleau and Lyon, Easton, Pa.

From a superficial point of view, the manufacture of Portland Cement would seem to be one of the simplest of operations mechanically, as there are only four main operations involved. First, the quarrying of the rock; second, the grinding and pulverizing of the same; third, the roasting of the powdered rock; fourth, the grinding and pulverizing of the resultant clinker, and of these four operations, numbers two and four are the same, and in most mills the same types of grinding and pulverizing machinery are used, both for the raw rock and the clinker grinding. Indeed, it sometimes happens that the machinery on the raw side is used to grind clinker when there is an accumulation of it in the field.

The analysis of Portland Cement is well understood nowadays, as far as all practical purposes are concerned. The formulas used in the different cement works do not vary much over 2 or 3 per cent in the carbonate of lime used, and there are no trade secrets, as far as that end is concerned. It would therefore seem that the cost of making cement should be brought down to a pretty fine point, and generally known to the trade, yet it is a subject of constant discussion and no two estimates agree. To begin with, there is necessarily a large variation in the cost between the mills located, for instance, in the Pennsylvania district, where the dry process is exclusively used, and the mills located in the West, using marl and clay, where a large quantity of water has to be evaporated from the slurry. To evaporate water, of course, means an increased consumption of coal, and as we will show later on that coal represents about 45 per cent of the cost of manufacturing a barrel of cement, the cost of manufacturing in the wet process plants is greater than in the dry process plants on account of the extra consumption of fuel.

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The following figures are taken from actual practice in mills located in the Pennsylvania district, and are consequently only true as referring to this class of mills, working entirely under dry process and having a rock that is easy to crush and that contains in itself in nearly correct proportions the essential elements for the manufacture of Portland Cement. Yet in this same territory the cost of manufacture varies for other causes. The majority of the plants in this region have to buy limestone. There are very few quarries that will give an average mix running as high as 77 per cent of carbonate of lime in the raw rock. To give, therefore, the actual cost of manufacture in this district, we would have to make up two sets of tables, one for mills with say somewhat old-fashioned machinery and kilns, and buying their limestone, and another for mills with absolutely up-to-date equipments and quarries containing sufficient limestone.

Again our figures do not refer to a mill that has just been started. It takes some time to get the men in the plant properly organized and accustomed to their duties, and it will take at least a year to develop a good quarry.

We have quarries in this region as much as 200 feet deep where a single blast will throw out a very large tonnage of rock, without any stripping to speak of. In a new quarry, the stripping is out of all proportion to the amount of rock available for the crushers, and the consequent cost of quarrying would be much greater than when the quarry will have a face of say fifty or sixty feet in hight, and, perhaps, 300 feet in width.

One more remark and we will give our figures, and that is that we are contemplating a mill with an output of 2,000 barrels per day, using the sixty-foot kilns that are generally in use in the business. Later on, we will have something to say about the modern kilns of 100 to 110 feet in length, that are being adopted for the most recent construction

The bulk of the labor in a cement plant is distributed in the quarry, the repair gang and the yard gang.

In a quarry of which we had charge, the amount of rock quarried, from Jan. 4 to Dec. 20 of one year, amounted to 55,-own rock, was about 5 cents per barrel of clinker. The power for running the drills and the coal, dynamite, oil, etc., are included in coal bills and supplies.

In the stock house, delivering directly from the cars to the crushers we needed only two men on each shift, one to attend to the stone drier, and one to watch the mouth of the big crusher. The bins were large enough to carry us over Sunday.

In the raw and clinker mills, we had on each shift, one raw miller, and one clinker miller, one oiler and one assistant oiler, one sweeper and one foreman.

In the fuel mill, we had on each shift, one engineer, one drier man, and one feeder.

In the kiln room, we had one burner for every two kilns, and one stock box tender.

In the engine-room we had one head engineer and one assistant on each shift. They looked after two 500-h. p. engines, the compressor, pumps, electric light plant, condensers, etc.

The boiler house was equipped with four 250-h. p. boilers, and we ran it with one fireman and one assistant on each shift. We did not have mechanical stokers, but the coal used (generally No. 2 buck), was delivered close to the boilers.

The plant from which these figures are taken is a good little plant. Its fuel bill was somewhat high on account of counter-shafting in the raw and clinker departments, and a wasteful engine in the fuel mill, but it was well above the average plant in this district, and for as many as eight weeks at a time it averaged from its six kilns over 1,300 bbls a day, and could be safely counted on for 1,200 bbls a day on long runs. The equipment was of the ball and tube type.

It is reasonable, therefore, to take the figures of cost of labor in this mill and use them for a mill of 2,000 bbls capacity, as the larger bill should be run with a greater economy of labor.

The yard gang consisted of 12 men and a foreman; these unloaded coal, limestone and other supplies and kept the plant in order, helped at times on the farm, in stripping, or, in fact, wherever needed on emergencies.

The repair gang consisted as follows: On the day shift, one head machinist, one helper, one blacksmith, one helper, one

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The packing house was without labor-saving devices, and the cost of running it was at times as low as 3¼ cts., and at times somewhat over 5 cts. per bbl. Equipped with tunnels and belting to deliver directly to the packing machines, the cost of 4 cts. per bbl. should be high.

In the office force we include a chemist, two assistant chemists, stock clerks, a mill superintendent, office clerk, shipping clerks, stenographer, testing boy, handy man and a teamster and four horses; all cost us 2 cents a barrel.

We figured on an average of 105 lbs. of gas slack coal per bbl. of clinker, and the cost of coal in the kilns is estimated on the basis that gas slack should not cost over $2.60 a ton f. o. b. the mill. We used under the boilers and in the dryers about 75 lbs. of coal per bbl. of manufactured cement and we are allowing $3.00 a ton for high-grade bituminous coal

The question of repair parts and miscellaneous supplies is the burning question in almost every plant. It is generally conceded, for instance, that the Griffin mill will run with less horse-power per barrel of output than the ball and tube mill, but many competent judges consider that the ball and tube mill is more economical in its repair parts.

As a general rule the wear and tear on the raw side is small, as the raw rock is as a rule easy to crush and pulverize, unless it is high in silica. A given mill, either of the Griffin type or the ball and tube type, will turn out some two or three times as much material on the raw side as it will on the clinker side.

The cost of repair parts for the ball and tube layout is much higher than for the Griffin mill layout, but in figuring up the cost of repair parts one cannot take the total cost of such parts, laying in stock house to be used whenever necessary, but only the average wear and tear, covering a long period of time.

The personal equation has an immense amount to do with the cost of repair parts and supplies. Unless a strict watch is kept by the superintendent and the clerk in charge of the supplies, there will be waste. We give a figure which is perhaps low as compared with the average practice. but which we know can be maintained with care, using a first-class layout.

Our figure for oil is high. The miscellaneous supplies is reasonable, but care must be taken in the mill to see that the shafts are all truly lined up and the mills properly set on their bearings, so that there will be no unnecessary breaking of gears or straining of shafting, etc. A little carelessness in this respect will very easily double the cost of repair parts and supplies.

The cost of erecting a cement plant is a very uncertain quantity. It will depend for instance on the location, on the closeness to railroad facilities, on the supply of water on the property, on the nature of the foundations, on the cost of building materials and labor at the time, on the kind of buildings used. Normally speaking, a mill that will do good work without any fancy features, can be constructed for $50,000 a kiln outside of land.

A first-class plant should be erected for $60,000 a kiln, also exclusive of land. In this district land has been bought recently on a basis of $200 an acre, and 100 acres is considered ample to supply a big plant. Some good-sized plants have only thirty to sixty acres, but part of the property consists of high bluffs and contains very large deposits of rock. It is therefore safe to say that $700,000 would cover all possible expenses for construction, land, promotion, etc., for a plant of 2,000 bbls. daily capacity. These figures are also high, as plants of the same capacity have been built for considerably less money.

There is a temptation when construction is once begun to make improvements not contemplated in the original estimates. Where the output is so large economies of even a cent a bbl. in the cost of manufacturing would show a saving of $6,000 a year or the interest of $100,000. It seems to us that it is possible to overdo this part of the work, and that in a cement mill where the wear and tear is great, the strain on the engines continuous and the average labor not any too highly skilled the best policy is to use the simplest and heaviest types of machinery.

Allowing the cost of $700,000, the interest charges on the same at 6 per cent, would amount to $42,000 a year, or 7 cents a bbl. per annual output of say 600,000 bbls.

The cost of administration of such a plant is also an uncertain quantity. Some plants are run by a general manager, he being practically the only highly salaried officer in the concern. The offices are at the plant itself, where the rent is, of course, nominal, and the extra clerk hire need not be large. The selling is done directly to large jobbers on a fixed commission and the cost per bbl. for administration would therefore be a small one.

If the company does its own selling, then, of course, it assumes a larger payroll and has to employ more men, though a small commission of say only 6 cents a

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barrel to the jobbers, would represent a sum of $36,000 a year, or enough to pay several good salesmen and also other officers of the company.

To these legitimate items of cost, there should be added in our judgment, a sinking fund and an allowance for depreciation, and wear and tear on the machinery.

The depreciation in some of the machinery in a cement plant is small, and, of course, the item of repair parts covers this depreciation to a certain extent. The buildings are not apt to deteriorate much if properly constructed at the start. The sum total of all these expenses should figure out as follows:

—Labor—		
Quarry	$0.05	
Stone house	.00½	
Mill building	.01½	
Kiln room	.01½	
Engine and boiler-room	.01½	
Fuel mill	.01	
Yard gang	.01½	
Repair gang	.02¼	
Miscellaneous	.00¼	
		$0.15
—Raw Materials—		
Coal	.22½	
Gypsum	.01¾	
		.24¼
—Supplies—		
Repair parts	.04	
Lubricants	.02	
Fiscellaneous supplies	.03	
		.09
Packing and shipping	.04	
Office force	.02	
		.06
Interest account on cost of plant	.07	
Sinking fund	.05	
Depreciation and wear and tear	.5	
Administration and selling expenses	.06½	
		.23½
		$0.77¾

The normal working year of a cement mill is really not over 11 months. In almost all plants there has to be a shut-down of from two to four weeks to give the machinery a thorough over-hauling.

During this period of shut-down, a great many of the men can be laid off. The custom is to keep the best men in January or February, when out-door work in the quarry is most expensive and the loss on that account is perhaps more apparent than real. Most of the men, too, after hard work of many months, are glad to have a period of rest. Still allowances must be made for this in counting up the cost of manufacture.

The chapter of accidents is an open one. There is always a certain percentage in a mill. At the same time, with casualty insurance, the cost of which is counted up in the administration expenses, the actual loss to the mill need not be very much.

It is safe to say that when cement is selling at the mill at 80 cents, or even less, the margin of profit is practically nil.

By leaving out the depreciation and sinking fund accounts, a small margin can be shown, but at the same time if the amount of money tied up in working capital, and the chances of bad debts are considered, there is no profit at all.

If the mill has to buy limestone, the extra cost will range anywhere from 5 to 14 cts. a bbl., depending on the quality of the rock in its own quarry, and its percentage in carbonate of lime. At present prices, therefore, in this district, it is safe to say that the majority of mills are, if not losing money, at least not making any for their stockholders.

In going over the figures given above, it will be noted that certain charges are practically fixed charges, and cannot be diminished to any extent. Other charges are susceptible of being considerably reduced. For instance, in a plant of 4,000 or 5,000 barrels of capacity, the administration charges could be almost cut in two. At 6½ cts. a bbl. given above, the tax on a 2,000-barrel plant would mean $130.00 a day; the same tax on a 5,000-barrel plant would mean $330.00 a day, though the cost of running the larger plant would not increase in anything like the same ratio. In fact a charge of 3½ cts. a bbl. for administration in a larger plant should be amply sufficient. A re-

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bbls. a day on short runs, and the 100-foot kilns have run as high as 475 bbls. a day. One 100-foot kiln will, therefore, safely do the duty of two 60-foot kilns.

There is, therefore, an economy in first cost of installation, as the 100-foot kiln can be bought for $5,000 and the 60-foot kiln costs $3,000; smaller buildings are required and less men to tend the kilns; also fewer conveyors, motors, engines, etc.

The question of economy of coal in the larger kiln has not yet been fully worked out. There is, however, admittedly an economy. It was claimed for the 150-foot kilns of the Edison Cement Company that they would use at times not over 70 lbs. of coal to the bbl. of clinker produced. Conservatively speaking, an economy of 2½ cents can easily be figured on from the use of the longer kilns.

Again, the engines in the plant which we have used for purposes of illustration were not of the most economical type, and there was considerable countershafting. Taking these various economies together, a plant built today on ground that has been thoroughly drilled and tested and proved not to require foreign limestone, and with good water and railroad facilities, would have an advantage of 6 to 8 cts. a bbl. over the best of its present competitors, and nearly twice as much over mills having to buy limestone. Such a plant would be able to do business at a reasonable profit where many of the existing plants would either be doing business at a loss or at a very small margin of profit; and such a plant would represent the same position toward the cement industry that the great Carnegie furnaces at Homestead, for instance, would represent toward the small plants in country districts; and such a plant would prove a profitable investment where a plant put up without regard to these conditions would simply be able to do a good business in flush years and have to shut down in hard times. The cement business seems to present many features in common with the iron and steel business.

There is, however, quite a field open yet for small plants where suitable raw materials can be found near large consuming markets, and where the advantage in freights to such markets and a smaller cost of coal would more than counterbalance the larger expense of running a small plant.

METHOD OF MAKING ELECTRICAL SURVEY OF ROCHESTER, N. Y.

The last report of the Department of Public Works of Rochester, N. Y., contains some interesting reports regarding electrical conditions in that city and the surveys for determining them.

The mileage of lines operated from the Rochester power station is 55.5, with 97 miles of track. The station is near the center of the system and its average output is about 4,000 amperes at 525 volts pressure, the variations being between 3,000 and 5,000 amperes

Mr. Albert R. Herrick has recently made a special survey and report and some recommendations of methods of relieving the bad conditions found in a few places, which do not agree in principle with those recommended in St. Louis. Some account of them will therefore be of interest. The accompanying rough sketches are from Mr. Herrick's report, using the same plates, and the following extracts and abstracts are also from Mr. Herrick's report:

"Electrolysis of subterranean metallic structures is primarily an accelerated erosion caused by certain conditions being present when a current escapes from a metallic surface. The current finds its way to the piping system, for it presents a path of conduction back to the power station, and the amount of current conducted by the water pipe will be in the ratio that the earth resistance plus the pipe resistance bears to the rail-return resistance at portions of the system adjacent to the power station (when the trolley wire is positive potential.) This current has to leave the pipes and return to the negative bus, for exactly the same volume of current must return to the power station as is sent out from it. If this current depart with sufficient electrical pressure between the pipe and adjacent moisture in the soil, it will change the constituents of the soluble matter held in the water, which will in turn, on account of their new form, more actively attack the pipe adjacent to the point where the solutions were decomposed. It is necessary to have the following elements in combination in order that the effect may be produced called electrolysis. A metallic surface surrounded by impure water and a current leaving the surface, having at the point of departure sufficient potential to decompose the soluble chemical constituents or organic

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matters held in solution in this moisture. The current leaving the pipe will cause the pipe to be positive relative to the surrounding electrolyte; this will cause an acid reaction due to the decomposition at this point.

"It is not correct to assume that all corrosion is electrolysis, for the composition of the pipe may be such that a local action will be set up within the structure of the metal itself. This is found to be the case with steel, where it has been rolled with particles of uncombined carbon incorporated with the metal. When the moisture of the soil rests against such a composite structure of carbon and the surrounding metal, the effect of this is to destroy or disintegrate the metal and leaves a carbonaceous substance of graphitic appearance which causes a pit of greater or less dimensions to be gradually formed on the iron surface. This is the case in the pitting of the steel pipe from Hemlock Lake. The test to prove whether steel for pipe construction has this peculiar composition is to submerge it in rain water, when the pittings will soon appear, if there is local action within the plate itself.

"Another cause where local electrolysis may occur is where lead pipe and iron pipe are connected and buried in the same soil, the soil forming the electrolyte when charged with moisture, the lead and iron forming two battery plates.

"Passing the consideration of those cases of electrolysis which are produced by foreign currents flowing from the structures, there are certain conditions that have to be understood in order to ascertain whether the structure is being deteriorated by the current; and the metal which forms the surface also determines the damage that can be done by the current under different conditions. With a given current density and potential, cast iron is affected the least, wrought iron the next, mild steel the next, high carbon steel the next, and lead the next. Lead, when affected by electrolysis, shows different peculiarities from those exhibited by the iron group. The carbonate of lead is formed when carbonic acid is brought adjacent to the back or insulate the pipe on whose surface they are formed electrolytically."

A section of track thirty feet long was arranged for testing purposes as shown in Fig. 1. This gives a cross section for all the forms of track described in the following table, thus showing the relative value these forms of track construction in preventing the passage of currents of electricity from track to pipe or their return. The results of the tests are as follows:

RESISTANCE TESTS OF TRACK FOUNDATIONS.

Per 1,000 feet, single track.

Dry test—

1. Rail on ties with earth tamped to the foot of the rail	0.583
2. Rail on ties concreted to foot of rail	0.612
3. Rail on ties covered with earth to the ball of the rail	0.391

Wet test—

1. Rail on ties concreted to foot of rail	0.52
3. Rail on ties covered with earth to the ball of the rail	0.153

In the dry test the earth was dry, in the wet test it had rained for a day and the ground and concrete were thoroughly wet.

"Concrete has two other valuable properties when surrounding the rail. With the soil over the rail, the fall of potential in the path of conduction from the rail to the surface of the pipe is gradual, except at the surface of the pipe, where it rises suddenly; the potential at this point is the critical potential, and on this potential depends whether the current will produce a decomposing action on the surrounding electrolyte or not. The current, in passing from the water pipe to the rail, will pass through mediums of various resistance, but through the medium of highest resistance will be the greatest fall of potential; consequently if we surround the rail with concrete, which is of higher resistance than the earth surrounding the rail, we will find that our distribution of potential in that circuit has changed, a large portion of it being lost in passing from the earth to the rail through the concrete, leaving only a small portion of it to be lost between

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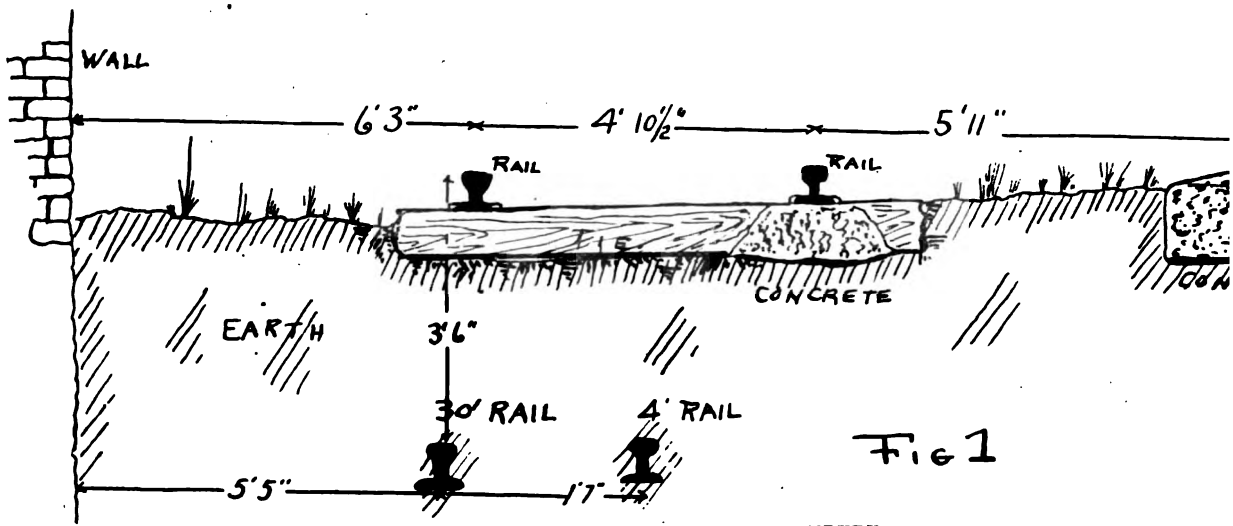

Fig 1

ROCHESTER ELECTROLYSIS SURVEY.

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the metallic substance of the pipe itself. Another effect that a concrete pavement or a water-proof pavement has, is to reduce the circulation of electrolyte surrounding the pipe surface. When we have passed the current from the surface into an electrolyte, we shortly decompose out of this water all the active agents; and if this electrolyte is not replaced but remains stagnant against the surface of the pipes, no further action occurs; the chemical activity being changed into heat, the energy disappears in this way, until the voltage rises to 1.47 when the oxygen and hydrogen in the water are then separated. The oxygen will then be in a nascent state, and becomes an active oxidizing agent; but with the enormous areas of pipe and rail presented, it is hardly possible for this condition to be reached, and it is only reached in the case of extremely concentrated action, such as service pipes underneath the rails and adjacent to them which make low-resistance leakage points, and if the potential is large between the pipe and rails at these points, an aggravated condition may arise where the chemical constituents of the water may be broken up.

"The physical relation of the water main and the track system has great bearing on whether damage will ensue from the current passing back to the power station over the piping system or not. It will be readily understood, in a system of rails, when passing toward the power station, that the volume of current received from the equipments will gradually increase.

"It can be further understood that if the underlying piping system tapers in its capacity and sizes, the same way that the current volume on the rail tapers, or in other words, the power station and pumping station are located near each other, the current which finds its way back on the pipe will have enormous areas to be dissipated from, and will maintain the current flowing from a given unit of surface, at a potential below that at which damage can ensue; but where the reverse disposition of the two systems holds, small areas are forced to disperse too large a volume of current for their safety."

Fig. 3 shows the method used in testing the difference in potential between rails and water pipes and the negative report, which shows, by means of sets of contour lines, the area of equal difference between negative bus at power station and rails by one set and water pipes by another set.

Tests were made for amount of flow of current in the water pipes. When the pipe could be reached the method shown in Fig. 4 was used. Any convenient length of pipe was used to measure the fall of potential, the contacts being well amalgamated and bridged as shown.

"The current flow in the water pipe can also be discovered by the same method by extending the leads between adjacent plugs on the same line of pipe and carrying out the same tests to discover the flow on the water pipe, but in this case there may be a poor electric connection between the water plug and the main. This connection should be tested by putting a heavy wire "A" between the rail and the plug, having an ampere meter in series with this wire, and if a volt meter "B" be connected to any other water service near this plug, and the rail and a volt meter were connected between the plug and the rail, as shown in Fig. 5, then the resistance of the connection between the plug and the main can be determined. Fig. 5 also shows another method of determining this point relatively, if the large wire "C" is connected between plugs and the current taken from the rail to the plug and an ampere meter is placed in the wire from the rail to the plug and also an ampere meter "D" in heavy wire between the plugs, the current when the wire is placed on the heavy rail will divide proportionately to the two paths offered it, and knowing the resistance of the wire between plugs will give us the relative conductivity of these two paths. Where there is any question as to resistance both plugs should be tested as to their electrical connection to the main.

"The method of determining the potential distribution between the track and pipe is shown in Fig. 6. In order that the true potential may be shown, no current can flow through the high resistance medium under test and a method of test must be used where no current flows nor any disturbance of the electrical condition should be produced by the instruments employed. What is known as the Poggendorff method must be used, and only one opening through

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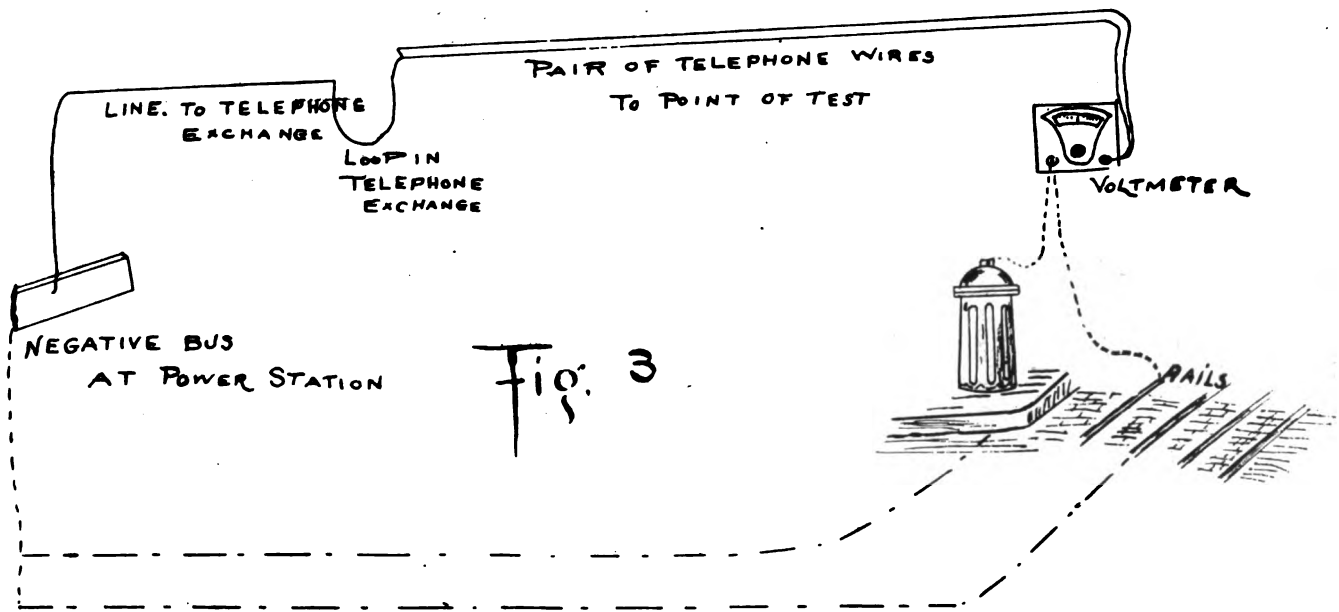

Fig. 3

ROCHESTER ELECTROLYSIS SURVEY.

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ferent points where the potential test is required. A standard battery is used, and across it is placed a variable rheostat of 1,000 ohms, but the direction of flow of this battery is opposed to the normal flow of current through the earth. A galvanometer is placed between the insulated metallic rod leading to the test mains and the variable contact on the rheostat. The contact is shifted until zero is read on the galvanometer, then the potential between the test plate and the water pipe is to the potential of the standard battery as the resistance of "C" is to 1,000 ohms, and this is the only

on one street and one not yet improved on a parallel or adjacent street give rise to this condition. Better bonding of rails is recommended to improve this condition.

A point or two where large return currents pass over small pipes should, according to Mr. Herrick, be relieved by a cable run from the negative bus and connected with all the pipes at the points where the electrolytic action begins, according to the "drainage" system.

Better connections are recommended across several bridges.

"A number of protective measures have

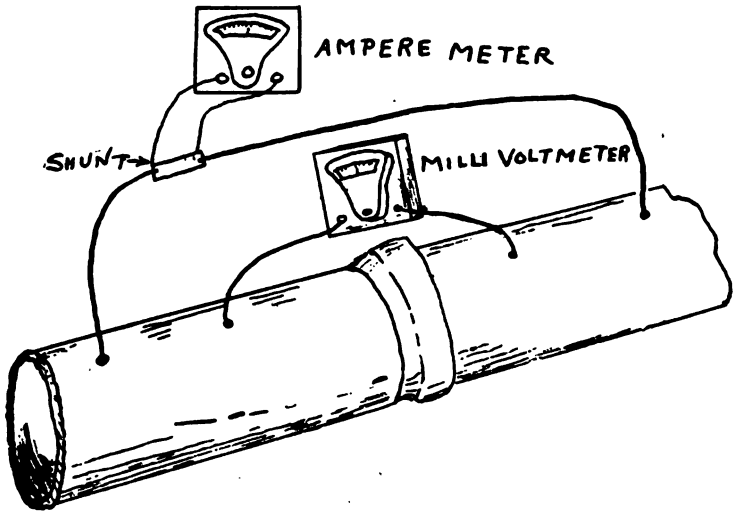

Fig. 4

ROCHESTER ELECTROLYSIS SURVEY.

means by which the potential can be correctly determined, for in placing a plate in the earth adjacent to the water pipe and measuring difference of potential. the resistance of the volt meter dis-

been suggested and tried. but the one that has met with greatest success in practice is what is known as the "drainage system." which takes the current from the pipe at the proper point by

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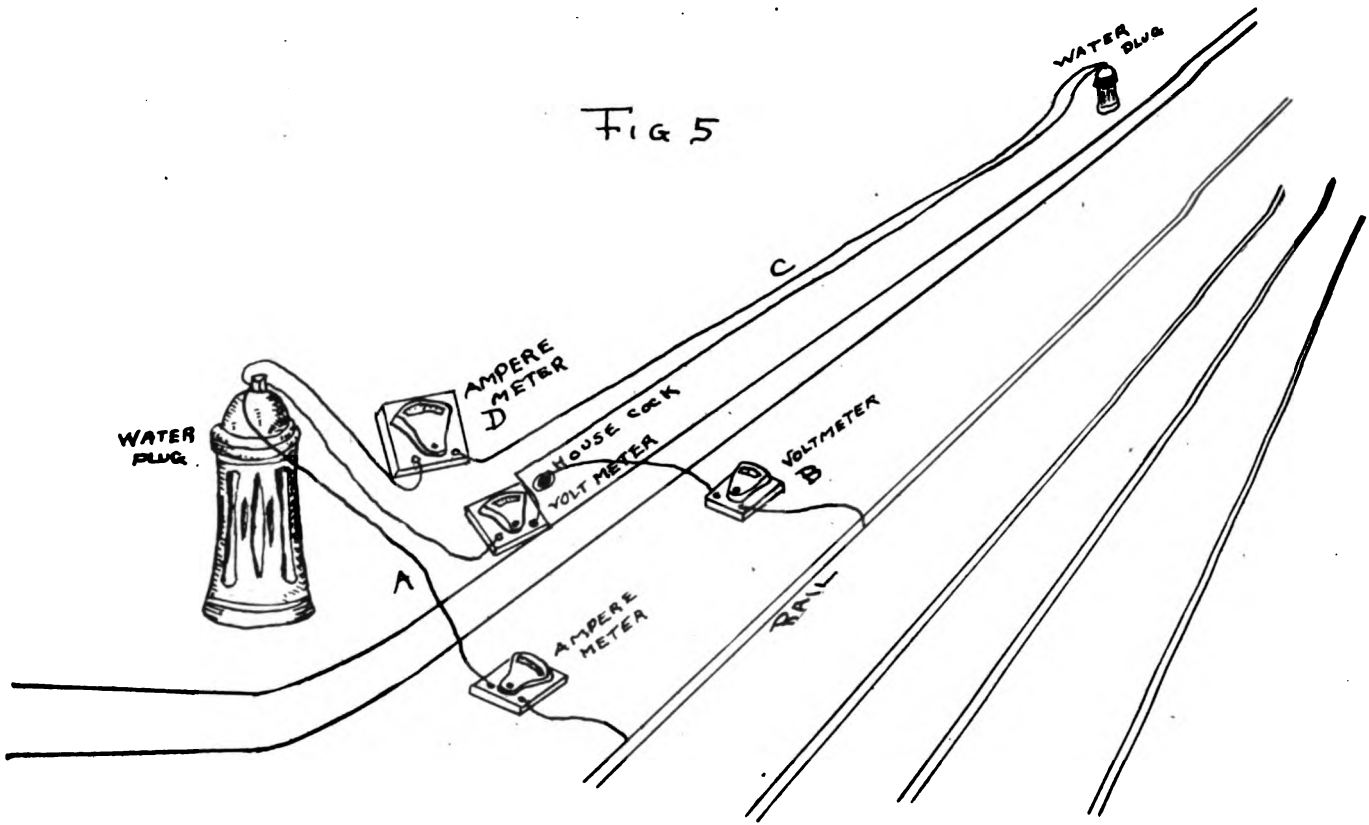

ROCHESTER ELECTROLYSIS SURVEY.

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which would naturally pass through it if it was left to seek its way through the ground back to the power station; and the other objection is, that a large current flowing along the pipe system may meet a poor electrical joint in the pipe itself, and at this point be deflected around the joint, and the portion of the pipe from which the current flows may be thus injured. This is purely a theoretical objection, and does not occur in practice nor have any illustrations of it been shown, for the reason that a constricted area of pipe presents such a high resistance, and the pipe system not being a single main but a quadrilateral system of conductors, of itself presents a number of metallic paths around the pipe in which section there is a bad joint.

"The practical outcome of such a system of protection when applied as in Rochester, is that it does protect all the mains, and in only a few cases have the services been affected, and in the cases where this has occurred it has been caused by the current being drained from a pipe which is too small to carry the volume of current flowing, and consequently will allow considerable difference in potential to exist between the rail and the pipe adjacent to the power station, and for this reason I have advised the changing of the ground connection to tap larger pipes on State-st. and St. Paul-st. A number of other methods have been suggested, such as insulating joints in the pipe; earth plate to drain the current from the pipe, and insulating the pipe, all of which are not direct methods. There are some cases arising where services are brought very close to the railroad tracks, and it is advisable under these conditions to box these services, filling them with asphalt, or slipping rubber hose over them, or taping them for at least four feet beyond the tracks under which they lie, in order to insure their life at such point of the system where the current is focused on these pipes in its escape to the rail; but I find these conditions not existing in Rochester, except along St. Paul-st., which will be taken care of by the feeder proposed; and along Lyell-ave., which will be remedied by connecting across the canal the rails abutting at the canal, and possibly along Dewey-ave., which is caused by the shuttling of the current toward Dewey-ave. which would be remedied by rebonding Lake-ave."

Mr. E. A. Fisher, City Engineer, in commenting on Mr. Herrick's report gives the following description of proper track construction:

"The best kind of track, both mechanically and electrically, is, first, a rail of not less than 100 lbs. to the yard electrically welded; second, a concrete foundation of twelve inches in depth under the rail, said concrete foundation six inches in thickness extending under the pavement to the curbs; third, a farm tile drain laid at least thirty inches below the top of the rail between the tracks; fourth, in the portion of the track near the power station, where large amounts of current are to be carried, supplemental wires of the proper capacity connected to the rails and extending to the negative end of the dynamo; fifth, cross-bonding of the rails and tracks; sixth, frequent connection between tracks in adjacent streets.

"The method of construction here described is that generally followed by the railway company in its track construction, and by the city in constructing new pavements for the railway company, since the year 1897."

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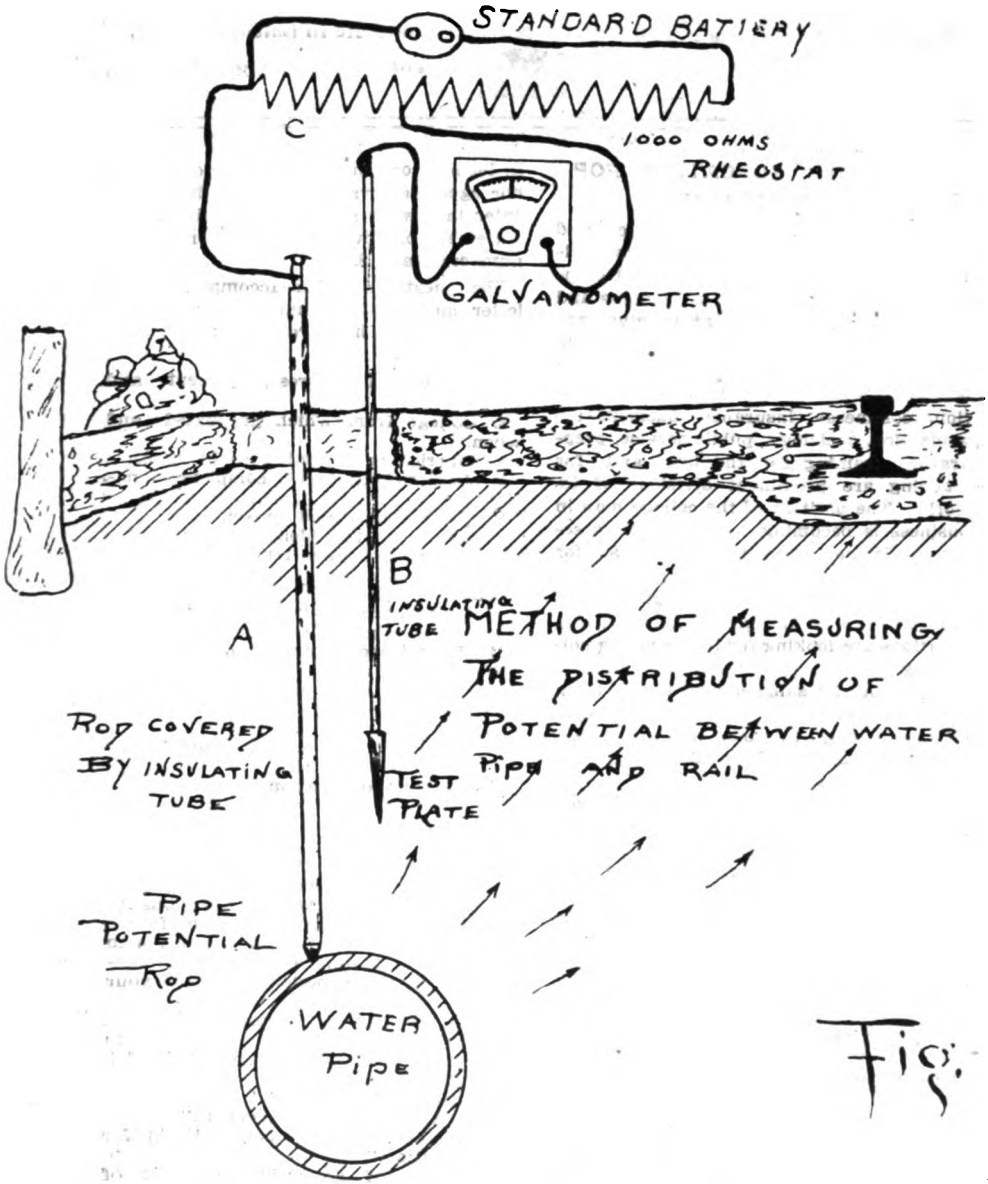

Fig. 6

ROCHESTER ELECTROLYSIS SURVEY.

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EDITORIAL COMMENT

University Education for Business Life.

How to Make Good Roads.

Concrete in Baltimore Fire.

Votes at Municipal Elections.

UNIVERSITY EDUCATION FOR BUSINESS LIFE.

The Wharton School of Finance and Commerce of the University of Pennsylvania was organized in 1881 to adapt higher education to the needs of business and public life. It is intended to give the development and technical training in these lines which the engineer gets in the technical school. Finance, transportation, commerce, insurance, business organization, sociology, public service, preparatory training for the law and for teaching are prominent divisions of its work. The position of the college man in business is becoming each year more secure. It has been measurably so for some time in technical occupations. The sujoined list of questions will show what the managers of the great industrial corporations are looking for in the young college graduate. The business man is looking for the same qualities and when he finds them in the man who has had a college training, this man has the preference at the start and can develop his future the most rapidly.

The following list of questions is asked by the chief engineer of one branch of a great construction company and is directed to young graduates in electrical engineering, but the principle is the same no matter what branch of business, trade or profession is looking for recruits:

"Enclosed please find a sheet giving outline of information desired from college graduates. Statements generally may be brief, but some of the subjects should be treated sufficiently at length to give us, as far as possible, what we it, let no mock modesty, on the one hand, nor egotistical vanity on the other hand, enter into what should be a plain, manly statement of your candid opinions, as to numbers 7 and 8."

The questions which accompanied this letter made up a remarkably searching examination. They are below:

1. Date.
2. Name and address, present and home.
3. College from which graduated and when.
4. Married or expecting to be soon.
5. Age, weight, hight, complexion, nationality.
6. Health, past and present
7. Habits, tastes, ideals, amoitions.
8. Disposition and temper.
9. Practical experience in engineering work.
10. Practical experience with machinery, tools or implements.
11. Experience in any kind of manual work. Have you a trade, what?
12. Experience in supervision, or "bossing."
13. Why took college course?
14. Why took engineering course?
15. Why took electrical engineering?
16. Father's occupation.
17. Have you ever worked for wages? Doing what?
18. What have you contributed toward the expense of your education?
19. Do you want work or opportunity; i. e., have you debts or obligations to meet which you must sacrifice the future for the present, or are you in position to begin at the bottom and receive promotion as you gain experience and find your work?
20. If convenient, inclose unmounted photograph and write essay equivalent to one typewritten page, on one of the following:

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young men of the right sort. Its attitude may be taken as typical of that of large concerns toward school-trained beginners everywhere, since a graduate in engineering is not an engineer. His training is very largely theoretical and a very large part of its value must lie in the discipline of mind proceeding from it.

HOW TO MAKE GOOD ROADS.

The office of Public Road Inquiries of the United States Department of Agriculture at Washington, D. C., has been circulating a letter asking each person who has been responsible for the construction of good roads to send to the assistant director, M. O. Eldridge, bull information, separate and distinct regarding each of the best specimens of typical kinds of road built by him.

The information asked for includes location and name of road; character of construction; source of material and distance hauled; kind, width and depth of material; kind and weight of roller; length of finished road; cost of finished road per mile, exclusive of bridges.

A carefully collected and collated mass of data on this subject would be of much value as an indication of the kind of work which is being done and the variations in cost. It is evidently the desire of the writer of the letter to reduce the amount of information directly asked for to a minimum and it may be found that the data thus collected will not have their full value, because even the skeleton of information asked for will not be filled out. The desire of road supervisors to make a good showing will reduce the chances of accuracy in reports. Many persons whose road-building days are over may be expected to report from memory with equally unsatisfactory results. Mr. Eldridge is likely to have a very difficult problem in separating the wheat from the chaff, and it is to be hoped for the good of the cause that he will not fail to reject information open to reasonable doubt as to its accuracy.

A little experience in gathering road data from men directly engaged in the technical side of it, when a little effort was necessary to get accurate data, showed the tendencies of the ordinary county official to guess at what would cause him a little trouble to ascertain exactly, and when to this tendency is added those of active and retired "practical" road builders, mentioned above, the results to be obtained are not very promising.

Much pruning and much personal correspondence will, however, result in considerable valuable material which will enable comparisons of materials, methods, costs and results in various sections to be made. The making of these comparisons should result in some good plans for improvement fitted to the local conditions in each section, and would reduce the loss of effort now so frequently experienced on account of failure to fit the remedies to the existing conditions.

This magazine has often called attention to the real economy of large amounts of comparatively cheap road in a growing section, as compared with short lengths of high-priced first-class road, reaching a very small district. The reliable data which can be sifted out of the mass of replies in the letter referred to will help to show how to make reasonably good roads within the prices which road districts are able to pay in each section of the country with due regard to the variations in local conditions and materials.

CONCRETE IN BALTIMORE FIRE.

Reports from various architects and engineers regarding the behavior of concrete in the Baltimore fire have been made since the last number of this magazine was issued. They all testify to the value of the material for resisting fire, with greater or less detail.

The general average of opinions seems to be that there were not enough buildings made of reinforced concrete in whole or in part and the concrete was not subjected to sufficient heat to determine its full value. Every building in which it was used passed through the fire and can readily be returned to its original condition, and floor beams entirely covered with concrete were successfully protected from destruction.

Capt. J. S. Sewell, in his report, gives the most details regarding the action of concrete under fire. He found some spallin of concrete on square corners and some calcining of stone in concrete on the surface to a depth of about three-fourths inch. Stone concrete spalls from expansion of air in cavities in the stone. Gravel concrete does not have the cavities and is therefore better for resisting fire. Broken bricks, broken slag, ashes and clinkers make good concrete. Cinders are unsafe if they contain any unburned coal, though one floor was observed in which some coal had burned out and the floor was still safe. Locomotive cinders are condemned for concrete. If made of the best materials un-

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der rigid inspection cinders make the best floor concrete, being both light and fire-resisting.

Similar results are indicated by some experiments made recently at Louisville. Temperatures were not accurately determined, but the heat was great enough to calcine the limestone used in some cubes and to disintegrate the cubes either in the furnace or on putting them in water, through the disintegration of the stone, the cement apparently retaining at least part of its strength. A cube of natural cement and cinder concrete was not injured by either fire or water so far as appearance would indicate. These experiments will be carried farther.

The ability of cinder concrete floor arches to stand 1,700 degrees heat for some time and then a stream of water was demonstrated in a New York experiment. Several other experiments indicate that both Portland and natural cement will lose strength on being subjected to heat without reference to the stone with which they are combined, but the laws of deterioration have not yet been determined.

One good result of the excellent behavior of concrete in the Baltimore fire will be the inducing of experimentation that we may know what materials must be used to obtain the best fire-resisting concrete.

VOTES AT MUNICIPAL ELECTIONS.

The last annual number of the "Monthly Bulletin of the Statistics Department" of the city of Boston contains some interesting figures regarding the number of voters at municipal elections. Of the 110,643 registered male voters in the city of Boston, 72.47 per cent deposited ballots of some sort at the election of Dec. 15, 1903. Of 18,515 women voters, 73.75 per cent deposited their ballots. These votes were cast for Mayor, Street Commissioner, Aldermen, for thirteen of which each man could vote; Councilmen, three in number; School Committee, for eight of which each man and woman could vote, and a special vote on licensing the sale of liquor. The Mayor received the most attention, 69.91 per cent of the voters casting ballots for the candidates for this office, only 2½ per cent less than the total number of men voting. Many voters did not mark all of the long list of Aldermen those registered voted on the license question.

The vote in each ward is given, and the percentages vary from 42.16 for an Alderman in the Eighteenth to 76.05 for Mayor in the Eighth Ward.

The diligence of voters in registering is indicated in a table showing the percentage of assessed polls which are registered for voting. For the whole city this was 59.95 per cent for 1903. Multiplying this percentage by that of those voting to those registered, 72.47, the percentage of men actually voting to assessed polls is 43.5, indicating that much less than half the possible voters exercised their right of franchise at this municipal election. The percentage in the various wards of registered voters to assessed polls varied from 29.23 in the Sixth to 79.02 in the Third. The percentage in the various wards of voting men to registered voters (men) varied from 64.69 in the Tenth to 78.67 in the Eighth.

The results for five years are compared, showing variations for the whole city in per cent of assessed polls registered from 59.95 in 1903 to 63.57 in 1902, and in per cent of registered male voters voting from 59.37 in 1902 to 81.11 in 1899.

There are, of course, many causes assigned for the difference between voting power and actual votes cast and a goodly percentage can be accounted for by reasons which are legitimate and do not indicate any serious condition of the body politic. A knowledge of the conditions in the various wards of the city might enable one to form a good idea of the size of this allowable percentage, but after illness, absence from home, imperative business and the like are accounted for, there is a large percentage of indifference remaining. How much of this indifference results from our methods of making nominations and the feeling of inability to control them, and from the inability to make a satisfactory choice between two evils can scarcely be estimated. That it is considerable cannot be denied.

Five years is not a long period from which to judge, but so far as it can be taken as an indication, there is no increase in the indifference to the question of voting. The variations in percentages from year to year seem to be without any law, so far at least as this particular question is concerned. The license question is voted on each year, and, while it

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variations from year to year. These are favorable indications that the average voter considers that his vote has a material effect upon the result.

Municipal campaigns are conducted too generally by the same organizations as the national organizations. It is natural that this should be so, since the great party organizations must be kept up and they are in working order for local as well as general elections. Organization is necessary, and good men can be found for municipal service in all the parties. The only change that it seems possible to expect under the conditions is to drop more out of sight the questions of national finance and policy and to substitute for them in the municipal elections the prominent local questions. This is done successfully in an increasingly large number of cities. When it is done, there is an increase of interest in local elections and votes on local questions.

One peculiar reason for a lack of interest of the individual voter in a municipal election is his impression that a national election is far more important than one which decides how his city shall be managed for the ensuing term. A man who will make all sorts of sacrifices to cast his vote for President will not take the trouble to go a few blocks out of his way to vote on the question of who shall expend his money for municipal improvements, even though he may have hundreds of dollars of taxes and assessments at stake. When too late for some special case he finds out his mistake. The lesson is being learned slowly, and the interest of voters in municipal elections is gradually increasing.

THE QUESTION DEPARTMENT

BRICK PAVING IN NEW ENGLAND.

What can you tell us of the use of shale brick for paving in New England?

T. H. G., Boston, Mass.

Until very recently there has been no brick suitable for street paving which was manufactured within shipping distance such that this material could compete in price with other paving materials. A few cities, such as Springfield and Worcester, laid brick pavements to some extent, notwithstanding the price.

Some brick plants have been started in New York and in New England within the past few years with the intention of supplying paving brick for the Eastern markets, but they have not yet met with the fullest success, some of the plants not being able to supply the proper quality of

PAVEMENT GUARANTIES.

I would like references to court decisions affecting the five-year maintenance clause of contractors' bonds.

F, ——, Ind.

It happens that most of the decisions of courts on this question, which have been published in Municipal Engineering, have been against the validity of pavement guaranties which in any way t the charge for maintenance of the pavement for the guaranty period upon those who were assessed for the construction of the pavement. These decisions are most of them given in states where the statutes definitely place the maintenance of pavements in the hands of the city officials and at the city's expense.

The principles upon which pavement guaranties may be justified are consid- [illegible] in some detail in an article entitled.

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regarding a decision by the California Supreme Court, made about the same time, to the effect that a city ordinance requiring a guaranty of pavements from injury by ordinary use is unauthorized by the statute and is therefore invalid.

In vol. xvi, p. 48, is a report that the Kentucky Court of Appeals ordered the assessment of the cost of a pavement upon the property-owners benefited, but refused permission to assess the 10 per cent of the cost which was retained to guarantee that the pavement would be kept in good condition for five years, this portion not being legally assessed and the assessment not being enforceable against property-holders. This decision was rendered early in 1899.

Guaranties were required on St. Louis pavements in 1898, vol. xiv, p. 356, but were declared by the Supreme Court during the same year to be invalid.

In vol. xxii, p. 250, will be found a report of a decision by Judge Walling, on Erie, Pa., in a suit of Erie City vs. Property-owners on E. Third-st., rendered March 4, 1902, granting a non-suit on the ground that the property-owners' liability ceases when the paving is paid for, the city being required to make repairs, the question in the case not being one of guaranty of good workmanship or of good material, but one of keeping a pavement in repair for ten years. In vol. xxiv, p. 39, it is stated that the Superior Court in Philadelphia reversed the decision of Judge Archibald of a lower court in the case of Williamsport vs. Nelson A. Hughes, who had decided that the property-owners need not pay for a seven years' guaranty and repairs. Judge Porter of the Superior Court held that this case was not like that of Scranton vs. E. B. Sturges, 202 Pa. Ct., 182, in which the Supreme Court declared an assessment illegal so far as the portion chargeable to repairs was concerned.

In vol. xiv, p. 357, it is reported that the retention of a $5,000 guaranty fund was upheld by Chancellor McConnell on May 6, 1898, in the case of the Ft. Payne Asphalt Paving Company vs. the City of Chattanooga, Tenn.

The Indiana Supreme Court upheld the sisippi, which have asphalt pavements, and which have no arrangement for maintenance; in other words, which do their own repairing.

D., Lima, O.

The following cities in the States named, having over 30,000 population are reported as having asphalt pavements: St. Louis Mo.; New Orleans, La.; Kansas City, Mo.; St. Joseph, Mo.; Minneapolis, Minn.; St. Paul, Minn.; Omaha, Neb.; Nashville, Tenn.; Des Moines, Ia.; Kansas City, Kan.; Houston, Tex.; Dallas, Tex.; Lincoln, Neb.; Topeka, Kan.; Sioux City, Ia., and Chattanooga, Tenn., Nashville and Chattanooga do some of their pavement construction and repair under direct charge of their officials.

Can our subscribers add to the above list those cities of smaller size in the States named, which have asphalt pavements, and designate which, if any, have municipal repair or construction plants?

NAMES OF CONTRACTORS AND OF MUNICIPAL OFFICIALS.

Have you a catalogue of contractors doing business in Indiana and Illinois? We also wish to find lists of names of public officials in the various cities and counties of Indiana.

INDIAN ASPHALT COMPANY,
Chicago, Ill.

The third edition of the "Directory of American Cement Industries" ($5), which has just been issued, contains lists of contractors using cement, and probably covers the ground desired. The latest lists of public officials in Indiana are contained in the last almanac issued by the Indianapolis Sentinel. Many municipal officials in the smaller cities are changed by the elections which occurred in May.

TRADE PUBLICATIONS IN STONE, LUMBER AND BUILDING MATERIALS.

Where can I get a list of publications reaching quarrymen, lumber dealers and dealers in building material?

K. D., ——— Mich.

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NAMES OF LARGE CONTRACTORS.

Can you give me the names of two or three large construction companies that make a specialty of building electric lines, water works plants, electric and heating plants and similar propositions? I desire the names of large companies who can handle large contracts, who are strong financially and can do some financing if found necessary in order to secure a contract.

J. S. M., Salt Lake City, Utah.

The following may be mentioned as among the reliable firms engaged in the construction of one or more of the classes of work mentioned:

Linch and Sproehnle, 916 Penn Bldg., Philadelphia, Pa.

Water Works Construction Co., 331 Fourth-ave., Pittsburg, Pa.

Townsend, Reed and Co., State Life Bldg., Indianapolis, Ind.

Other firms which can put our correspondent in touch with those who can do the work desired are the

Osborn Engineering Co., Osborn Bldg., Cleveland, O.

Municipal Engineering Co., 41 Wall-st., New York City.

PAPER TRADE JOURNALS.

We would like the names of periodicals making a specialty of paper manufactures. We have started manufacturing roofing felts and find a difficulty in getting the proper papers.

B. W. MANSELL,
Sydney, N. S. W.

The following are names of paper trade journals in America which would probably be of interest in the line mentioned:

"Pulp and Paper Magazine," Toronto, Ont.; "Paper Trade," Chicago, Ill.; "Paper Mill Wood Pulp News," 21 Park Row, New York City; "Paper Trade Journal," 150 Nassau-st., New York City; "United States Paper Maker," New York City.

CITIES HAVING SEPTIC TANKS FOR SEWAGE TREATMENT.

We would like the names of cities having septic tanks installed in connection with their systems of sewage.

C. H. TOPP,
City Engineer, Victoria, B. C.

Descriptions of septic tanks at the following places will be found in the Engineering Record as follows: Columbus, O., vol. xxi, p. 288; Madison, Wis., vol. xxi, p. 302; Brentwood, N. H., vol. xviii, p. 30; Pawtucket, R. I., vol. xx. p. 163; Soldiers Home, Santa Monica, Cal., vol. xxvi. p. 1; Bedford, Ind., vol. xxvi, p. 109; West Allis, Wis., vol. xxvi, p. 111; Eastern Insane Hospital, Richmond, Ind., vol. xxvi, p. 178.

There are septic tanks in operation also at Plainfield, N. J.; Stamford, N. Y.; County Farm, Milwaukee, Wis.; Indiana Industrial School, Plainfield, Ind.; Lake Forest, Ill.; Holland, Mich.; Danville, Ky. Sycamore, Ill.; Princeton, Ill.; Wauwatosa, Wis.; Worcester, Mass.; Collingwood, N. J. and in many other places. It will be noted that all of these plants are small, either because the amount of sewage is small or because, in the cases of the larger cities mentioned, the plants are experimental in their character.

This list will be added to as information regarding other plants is received.

BOOKS ON SEWERAGE.

I am looking for good books on sanitary engineering and sewerage; what ones would you recommend? What discount do you give on books? M. P. H.,
Ann Arbor, Mich.

A list of good books on sewerage and sanitary engineering will be found in the advertising pages almost every month. In the May number it appeared on page 72. To this list might well be added Moore's "Sanitary Engineering" ($10 net), which is a recent English book of great merit. These books will be sent by the business department of this magazine on receipt of the list prices and upon the terms given. These books are handled only for the convenience of our readers and the margins are not sufficient to warrant discounts.

PREVENTION OF SPARKS FROM LOCOMOTIVES.

I would be glad to learn where there is any literature on the subject of prevention of the smoke and spark nuisance on railway trains. P. C. N.,
Syracuse, N. Y.

There is a short discussion of this subject in the proceedings of the Indiana Engineering Society for 1903 (50 cents), by Prof. W. F. M. Goss and others, showing

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Doubtless the various railway clubs throughout the country have discussed this subject and their secretaries may be able to make reference to the reports of these discussions and to written papers. One such discussion by the New York Railroad Club occurred about ten years ago. Engineering Magazine gives each month a long list of these clubs with names and addresses of secretaries.

THE WATERPHONE.

Can you give us the address of the party manufacturing the Bell waterphone? D. E., Chicago, Ill.

The Bell waterphone was formerly manufactured in Cincinnati, but, so far as we can ascertain, is not now on the market. One can be improvised by using a telephone receiver with the inside magnets removed. The water can be turned off partly by means of a stopcock key, and the telephone receiver, applied to the key while still in position on the stopcock, will detect the slightest flow through the cock.

FULLER'S EARTH.

Where can I get information in regard to Fuller's earth, its uses, probable market value, etc.?
C. E. S., Kingfisher, Okla.

Fuller's earth is not very generally found in this country. The principal deposit which has been worked heretofore is at Quincy, Fla., Deposits in South Dakota, Colorado and California have also been worked to some extent. The demand for this material is not great, the production in 1900, for example, being 11,813 tons with a value at the place of production of $70,565, or about $6 a ton. In the same year the importations were about 9,000 tons with a value of $65,000 or a little over $7 a ton. In the same year the market prices in New York were from $15 to $18 a ton for lump and powdered earth and about $25 for refined. Fuller's earth is used for fulling wool, but in the territory of our correspondent its principal use would probably be for deodorizing oils and fats and removing colors. All the refiners of lard and cottonseed oil and the makers of cotto-

PRICES CHARGED FOR GAS AND ELECTRIC LIGHT.

I would like to secure a reliable and authentic statement as to the prices charged for illuminating and fuel gas per 1,000 cubic feet in cities and towns located in the Central Western States. Also regarding the prices charged for electric lighting, meter rates per k. w. for commercial purposes and per lamp per month for street lighting purposes in the same class of cities and towns.
F. M. N., Mason City, Iowa.

The following prices for gas are compiled from the latest edition at hand of Brown's "Directory of American Gas Companies" ($5), and are for cities of 6,000 to 10,000 inhabitants:

	—Gas for Light— Gross.	Net.	—Gas for Fuel— Gross.	Net.
ILLINOIS—				
Belvidere	$1 80	$1 50	$1 80	$1 50
		to 1 10		to 1 10
Canton	2 00	1 50	1 50	1 00
		to 1 25		to 90
Centralia	1 50	1 35	1 50	1 35
Champaign ...	1 75	1 50	....	1 50
Dixon	....	1 00	....	1 00
		to 1 90		
Kewanee... ..	1 50	1 40	1 50	1 40
Lincoln	1 50	1 40	1 50	1 25
Mattoon	1 50	1 35	1 50	1 35
Monmouth ...	1 50	1 50	1 25	1 25
Murphysboro.	1 50	....	1 25	....
Paris	2 00	1 50	1 50	....
Pekin	1 10	1 00	1 10	1 00
	to 1 50	to 1 35	to 1 50	to 1 35
Sterling	2 00	1 80	1 50	1 35
Waukegan ...	1 25	1 15	1 25	1 00
INDIANA—				
Bloomington..	....	1 00	....	1 00
Columbus	1 25	1 25	1 00	1 00
Connersville .	1 50	1 35	....	....
Crawf'dsv'le .	1 50	1 50	1 00	1 00
Goshen	1 25	1 20	1 25	1 20
Huntington ..	1 50	....	....	....
Laporte	2 00	1 60	1 50	1 35
Madison	....	1 50	....	1 00
Peru	2 00	1 50	....	
Seymour	....	1 50	....	1 25
Shelbyville ...	....	1 50	....	....
		to 1 80		
Valparaiso ...	1 25	1 20	1 10	1 05
Washington .	2 00	....	1 50	....
IOWA—				
Boone	1 50	1 12	1 50	1 12
		to 1 35		to 1 35
Creston	2 00	2 00	1 50	1 50
Ft. Madison ..	1 85	1 50	1 55	1 25
Iowa City	2 00	2 00	1 50	1 50
KANSAS—				
Ark. City	....	2 00	....	1 50
Emporia	2 50	1 50	....	1 50
Hutchinson ..	2 00	....	1 50	....
Newton	2 00	1 50	2 00	1 50

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MISSOURI—				
Carthage	2 00	....	1 50	....
Chillocothe	1 65	....	1 25	....
Inde'p'dnce	2 00	2 00	1 50	1 50
Jeff's'n City	2 00	1 80 to 1 90	2 00	1 50
Moberly	2 00	2 00	1 50	....
Nevada	2 00	1 50	2 00	1 50
St. Charles	1 75	1 65	....	1 40
NEBRASKA—				
Beatrice	2 00	1 50	2 00	1 25
Fremont	3 00	1 20 to 2 10	3 00	1 00 to 1 50
Gd. Island	2 50	2 00 to 1 20	....	1 20
Hastings	2 25	2 02	....	1 90
Neb. City	1 75	1 70	....	1 60
WISCONSIN—				
Chip'wa F'ls	....	2 00	....	1 50
Stevens Pt.	2 00	1 50	1 75	1 25
Watertown	1 80	1 60	1 60	1 40
Waukesha	1 40	1 30	1 40	1 30

With reference to charges for electric light, reference may be made to the table in Municipal Engineering, vol xxvi., p. 55, for prices of street arc lights and for meter rates and discounts for lights for commercial purposes, in sixty-four cities with population from 5,000 to 15,000, in Illinois, Indiana, Michigan, Ohio and Kentucky.

The following additional data are from Brown's "Directory of American Gas Companies:"

FORMULA FOR SIZE OF BRIDGE MEMBERS.

Please explain the following formula: Intensity of working stress, compression, is 18,000 pounds minus 70 times l divided by r, for a chord made up of two 10-inch 20-pound channels and a plate of 12 inches by ¼ inch. Which radius of gyration is proper to use? Would it be proper to take the sizes for a chord member and for posts from the Cambria table for safe loads for latticed channel column, pages 246 to 276, edition of 1903? READER.

Guthrie, Okla.

The formula is nearly Cooper's modification of T. T. Johnson's straight line formula for compression members in a truss, with the factor of safety reduced slightly below 3. This is low for dead loads and the constants should be doubled for live loads. The letter l in the formula is the length of the piece and r the least radius of gyration of its cross-section, both in inches. The radius of gyration to be used is that of the entire section and not that of any of its parts. The radii of gyration about axes parallel and perpendicular to the webs of the channels should be as nearly equal as the construction details will permit, and if not equal the smaller must be used in the formula.

The tables on pages 246-249 of the Cambria handbook give the safe loads for

	Public Lighting.					Commercial Lighting.		
Cities.	No. Arcs and Candlepower.	Hrs. per Year.	Price Per Year.	No. Incan. and Candlepower.	Price Per Year Except as Noted.	Price of Arc Per Month.	Price of Incandescent Per Month.	Meter R'te Cts. Per kw-hr.
ILLINOIS—								
Canton	125-1,200	2,161	$48 00	.....	.....	$4 50	.....	10
Champaign	140-2,000	3,000	65 00	200-16	$0.75 lp-hr.	5 to 7	.....	0.75*
Kewanee	46-	2,500	70 00	.....	.....	.....	.....	6.3-18
Macomb	4-2,000 14-1,200	2,700 2,700	96 00 72 00	.....	.....	6 00	50 to 60c	.....
Murphysboro	50-	A. N.	120 00	.....	.....	6 40	60c to $1.20	.....
Paris	.....	.....	.....	.....	20c kw-hr. $17-25 c. p.	5 00	40 to 85c	.....
Sterling	10-2,000	A. N.	80 00	214—	.....	6 50	.75c to $1.50	20c
INDIANA—								
Huntington	.....	.....	60 00	.....	.....	.....	50c	.....
Seymour	90-2,000	.....	65 00	1,000	.....	5 00	.....	10c
Valparaiso	66-	M. L.	67 56	.....	.....	6 00	80c	
IOWA—								
Creston	28-2,000	.....	66 38	— -16 — -32	75c to $1.25 $1.25 to $2.08	7 00	$2-16 c. p. $2.50-32 c. p.	.....
KANSAS—								
Arkansas City	31-2,000	2,910	72 00	.....	.....	6 00	$1-16 c. p. to 2-50 c. p.	$1.25†
Hutchinson	34-2,000	.....	100 00	.....	.....	8 00	$1-16 c. p. $2-32 c. p.	17c
Newton	17-2,000	2,190	92 00	.....	.....	8 00	.....	15c
Salina	34-2,000	1,800	90 00	10-16	$12 00	.....	$1.75 to $3.50	20c

* Per 16-candle-power hour.

† Per ampere hour.

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a factor safety of 4 according to Gordon's formula, for struts made of two channels connected by lattice bars. If the section in question has but one plate, and the opposite flanges are latticed, it would be stronger than the corresponding strut computed from the table. On pages 248 to 277 the struts are made of two channels and two plates, making a closed box column or strut. It would not be safe to assume the strength of the section described equal to the corresponding column in this table on account of the greater cross section of the latter and the difference in position of the center of moments of inertia. It should be remembered also, that the factor of safety in the table is 4, suitable for dead loads, and that it should be doubled for live loads. This would make the average factor of safety for the piece lie between 4 and 8, according to the relative size of live and dead loads to which the piece may be subjected, some attention being paid also to the amount of variation in stress which may occur.

CONDUITS FOR UNDERGROUND WIRES.

What work is there published treating of the method of construction of conduits for underground wires?

T. H. S., Quincy, Ill.

This subject is treated in one or more chapters of Crocker's "Electric Lighting," 2d vol. ($3), Abbott's "Electrical Transmission of Energy" ($4.50) and Miller's "American Telephone Practice" ($3). Specifications for construction are also given in Abbott's "Conduits for Telephone Work" (50 cents). Reference may be made to Municipal Engineering, vol. xxvi, p. 311, for an article on "Conduits for Electric Wires." There is much valuable material in the trade literature of the makers of conduits. Addresses of makers of conduits of various materials will be found in the "Business Directory" elsewhere in this number under the heading, "Conduits."

EARLY MANUFACTURE OF PORTLAND CEMENT WITH THE ROTARY KILN.

Will you kindly let us know if you have has not treated the history of the industry prior to its own establishment which was about the last date mentioned. The introduction to the "Handbook for Cement Users" ($3) and the descriptions of works for the manufacture of cement to be found in that book and also in the "Directory of Cement Industries" ($5), the third edition of which has just been issued, give brief descriptions of these experiments as steps toward the new methods which are based upon them.

CEMENT PIPE FOR WATER WORKS.

Can cement pipe be used for water works piping systems? If so, how thick ought the pipe to be to withstand safely the ordinary hydraulic pressure of a city water works supply. What is the safe load such a pipe can bear? I notice that the water department here has to take up from time to time pieces of mains, branches, Y's, T's and so forth, made of cast iron, as they often become corroded and full of small holes through electrolysis. C. T., St. Louis, Mo.

It has never been proposed to use cement pipe for water pipe under any very appreciable pressure, and the fact that the tensile strength of cement mortar is measured by hundreds of pounds, while that of cast iron is measured by thousands, and of wrought iron or steel by tens of thousands, shows the principal reason.

The tensile strength of wrought iron and steel is so much greater than that of cast iron that attempts have been made to use those forms of iron. The destruction of the steel pipe by corrosion is so much more rapid on account of the less thickness to be corroded that some protection is necessary and cement has been used with greater or less success. The difficulty of making joints and taps which will be water-tight and will not expose the steel shell to corrosion, with some mistakes in design and carelessness in manufacture and placing of pipe, have practically driven the pipe out of the market, but little now being used except for some special purposes for which it may be adapted. The use of steel reinforcement, such as rods, wire cloth, expanded metal, etc., has been proposed and has been fairly successful in some

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by this method of construction is doubtful. If electrolysis should take place the destruction of the pipe would take place very soon, on account of the much smaller section of metal to be corroded.

WHITE CEMENT BLOCKS—CEMENT BRICK FOR CHIMNEY.

Will you kindly inform me how to color cement blocks? Can they be made white instead of gray, the natural color of Portland cement?

Will cement brick, made 4by8, laid up for a chimney, stand and be as good as kiln-burnt brick?

E. S. C.,
Belding, Mich.

Cement blocks may be colored by using coloring matters as described in the "Hand-book for Cement Users" ($3). Reference may also be made to Municipal Engineering, vol. xx, p. 302, and xxi, p. 405, for some information on the subject. There is no way of making cement white. By the use of crushed marble for the broken stone or of marble screenings for a part or all of the sand, a reasonably white block can be obtained. If carefully done expense can probably be saved by using this mixture with marble as an outside facing, the rest of the block being made at the same time with the ordinary mixture.

Cement brick are stronger under compression than building brick of the kind ordinarily used in chimneys, and would be entirely satisfactory so far as strength is concerned. A concrete containing much limestone or marble would be disintegrated by a temperature sufficient to turn the limestone into lime, but proper temperatures in the stack would not be hign enough to have this effect. Most kinds of gravel, trap rock and such refractory materials would not be liable to this danger.

CEMENT LINING FOR RESERVOIRS.

We have in our city a reservoir, octagonal in shape, 130 feet across and 13 feet deep. It is built on a ledge and leaks so badly that it cannot be used. The ledge is full of seams. The whole has been covered with a layer of cement 2 inches in thickness in some parts and not over a half inch in other parts. Can we stop may be spread the coatings of concrete and cement mortar as suggested in the question. In Municipal Engineering, vol. xxvi, p. 352, will be found an article on "Impervious Concrete," which explains the principles by which the concrete should be mixed. Description of the concrete reservoir lining of the Forbes Hill reservoir at Quincy, Mass., will be found in the "Hand-book for Cement Users" ($3) on pages 135 and 180. Reference may also be made to Municipal Engineering, vol. xxi, p. 328, for report of practice in several cases. It is there stated that in instances named from 18 to 24 inches of clay puddle was carefully put in place under the concrete when it was necessary to have the reservoir absolutely watertight.

MACHINE FOR MAKING SEWER.

Can you give me any information as to where to get a machine for the manufacture of large size sewer?

R. J. P., Tallahassee, Fla.

If sewer pipe is meant, reference may be made to the answer in this department to the question on "Cement Pipe Machinery," for machines for making cement sewer pipe. The machines for making vitrified pipe are made by such firms as the American Clay Working Machinery Co., Bucyrus and Willoughby, O., Akron Engineering Co., Akron, O., etc. If machines for excavating sewer trenches are wanted, reference may be made to the "Business Directory" printed in each number of Municipal Engineering, under the headings "Sewer Machines" and "Trench Machines."

SEA WATER FOR MIXING CONCRETE.

I would like some information as to the merits of sea water and fresh water for mixing concrete. Have any comparative tests been made and with what results?

JAMES J. TAYLOR,
New Glasgow, N. S.

Studies of the effect of sea water upon cement and concrete were made some years ago by Vicat in France, briquettes and blocks made up with fresh water

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ments were made with coment briquettes made with fresh water and then subjected to the action of sea water, and also with cement briquettes made with various proportions of fresh and sea water. The former series showed progressive improvement in the strength of the briquettes for the six months of observation. The latter series showed some little diminution in the strength of briquettes in tension with increase in amount of sea water, with one or two discrepant results. Thus at nine and twelve months briquettes showed the following tensile strengths·

	9 mon.	12 mon.
Fresh water	949	678
Half fresh, half sea water..	965	592
One-fourth fresh, three-fourth sea water	950	575
Sea water, 25 per cent evaporated	890	605
Sea water, 50 per cent evaporated	970	495

The results showed gradual increase in strength up to nine months and then the serious decrease at twelve months. These results are not sufficient for any definite statement, since this falling off in strength might have been due to the quality of the cement rather than the effect of the sea water.

Mr. Wm. Smith, in a paper on the deterioration of the Aberdeen breakwater, attributed the failure of the concrete to the presence of an excess of free lime in the cement and the action of the magnesia and the carbonic acid in the sea water, the resulting decomposed cement having in its composition a large percentage of hydrate of magnesia, of which the original cement had none, it having apparently replaced some of the free lime which was present in the original cement.

M. Chatelier, in a paper before the International Congress on Testing Materials, three or four years ago, made a study of this subject, with regard to concrete subjected to the action of sea water, and reached the conclusions that the presence of alumina in combinations in which it may be hydrated, is dangerous as its amount increases to 4 per cent water, point to the careful examination of any cement which is to be used in sea water, that its suitability may be determined before it is used. The continuous action of sea water upon an unsuitable cement would doubtless be more serious than that of sea water used in mixing concrete which is deposited where there is no danger of later submersion in sea water, but a cement which would fail under the first condition might well be expected to show weakness under the second.

WEARING OFF OF CEMENT WALK SURFACE.

I have a walk made with a certain cement where the corrugations wore off in two months. The surface was finished in 1 to 2 of ordinarily good river sand. I keep fine sand on the finished walk for ten days and keep it wet down with plenty of water. There was no walking on it for four or five days. Is the fault in the cement?

M. E., Norfolk, Neb.

The cement named is made of limestone and clay and has an excellent reputation on the market for sidewalk work. Unless, therefore, there was some trouble with the individual shipment, the defect was probably not due to the cement. Dirty sand, drying out before the cement has time to set, and too much troweling in finishing are the usual reasons assigned for the rubbing off of the surface of a walk. A cement which has not been sufficiently cured may also cause the same trouble. A practical cement worker says that the trouble comes from the wet sand which delays the setting of the top. Either more time should be given for setting or the walk should be wet down at intervals in the usual way instead of being soaked with moisture as it is by the use of the wet sand. Our readers are invited to report their observations upon this problem.

BRICK OF CEMENT AND SAND.

Can you tell me anything as to the comparative merits of the various brick

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cement brick machines, and there are also several of the makers of hollow concrete block machinery who supply machines for making brick. Reference may also be made to the "Business Directory" published in each number of Municipal Engineering for names of makers of brick and block machines under the headings "Cement Brick" and "Cement Construction."

The difficulty in the manufacture of cement brick seems to have been largely in the handling. In some processes using pressure, a mortar soft enough to insure filling the molds is too soft to remove promptly when the bricks are formed, or at least to transfer to the drying sheds, and with any process the bricks are difficult to handle until the cement has had time to set. The process of tamping is slow in some molds, but seems to be more rapid in others. The makers of the brick machines have been at work on the solution of these problems and the machines offered are quite different in method of operation. Some are very elaborate and require a large establishment for economical operation, while others are very small and simple and can be operated anywhere. But few of them have been in operation long enough to be able to report fully regarding all the points on which information is desired. As opportunity offers these reports will be given.

CEMENT FOR WHEELWAYS FOR COUNTRY ROADS.

Of the cement beds now operated which would suggest itself to you, combined with crushed rock, as probably practically available for rural highways made with a wagon wheel track a foot or more wide with gravel or other material for the draft animals? Even in Ohio and Indiana there are many sections where road surfacing material is not locally available in large quantity.

J. E. P., Chagrin Falls, O.

Wheel tracks of cement concrete would have the common objections to all wheel tracks, viz: cutting away of the gravel or macadam alongside so as to make it difficult to get on and off the tracks at will, especially with two-horse teams, whose horses must travel partly on the wheel tracks and partly on the gravel alongside; unequal settlement, especially when the blocks are small; great cost for double lines or else for proper construction and maintenance of the rest of the roadway so that turnouts may be made at any place that vehicles meet. In addition they would have the tendency to wear and break off at the edges under the action of the wheels in getting on and off the track, and would probably be as slippery under the horses' feet as are the steel trackways which have been tried.

Experience so far has indicated that the only place where smooth trackways are economical is in streets with very heavy traffic, which are paved with very hard and comparatively rough material, like stone blocks, or comparatively soft and destructible material. Even here, however, they are not used by the teams, for the width of wagon tracks is such that the horses travel on the same lines as the wheels, and it is easier for them to pull on the rough pavement, even though the tractive force exerted is much greater, than to slip on the smooth wheel ways. The successful smooth trackways have been of stone blocks smoother than the blocks of which the rest of the street is built, or on streets so narrow that but one wagon can pass at a time and two ruts form in any pavement which can be put down.

Unfortunately, two materials of different strength and durability cannot be used in a pavement in this way without exaggerating the wear of the softer material in spots and thus reacting upon the harder material as well as preventing the easy use of the combination and thus defeating the object for which it was constructed.

GRANITE SCREENINGS FOR MOSAIC WORK.

Can you give me the address of a dealer who handles granite chips or screenings for mosaic floor work? I cannot use mosaic tile.

F. C. S.,
Muskogee, I. T.

Reference may be made to the "Business Directory" published in each number of Municipal Engineering under the heading "Crushed Stone" for dealers in this material. Those named furnish crushed limestone, sandstone, dolomite or "quartz," and screenings of the same. Names of granite and quartz producers in Wisconsin, Indiana, Ohio and Eastern States will be found in Municipal Engineering, vol. xxv, p. 24; vol. xxiv, p. 357; vol. xxiii, p. 32. The following in St. Louis, Mo., may be added: The St. Louis Crushed Quartz Company (dolomite), 311 Roe Bldg.; P. M. Bruner Granitoid Company, 816 Olive-st.; J. C. Finck Mineral Milling Company, 101 Barton-st.; Milne & Gordon, Jefferson and Missouri Pacific Railroad; Schneider Granite Company, Fullerton Bldg.

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CEMENT PIPE MACHINERY.

Will you give me the names of manufacturers of machinery for making pipes for drains, sewers etc., of cement?

J. E. B., Baltimore, Md.

Reference may be made to the "Business Directory" printed in each number of Municipal Engineering, under the headings "Cement Pipes Molding Press," "Cement Sewer Pipes," and "Cement Sewer Pipe Machinery," and to the advertising pages for the following makers of machinery for making cement pipe:

Cement Tile and Tile Mould Manufacturing Company, Sac City, Iowa; Jackson Cement Sewer Pipe Company, Jackson, Mich.; H. Schebye, 348 Carolina-st., Pittsburg, Pa.; Cement Machinery and Manufacturing Company, Burlington, Ia.; also the Brady Cement Stone Company, Jackson, Mich.

The Stevens Cast Stone Company, 808 Chamber of Commerce Building, Chicago, Ill., can furnish molds for making cement pipe.

CEMENT STATISTICS—STRENGTH OF CEMENT MORTAR AND CONCRETE.

Kindly give us your latest statistics on the consumption of Portland cement in the United States.

We also want the tensile and crushing strength at 7, 28 and 60 days in air of mixtures of cement and sand in proportions of 1:2, 1:3, 1:4, 1:5, and 1:6 and of 1:2:4 of cement, sand and broken stone.

C. M. C., Jackson, Mich.

Reference may be made to Municipal Engineering, vol. xxvi, p. 149, March, 1904, for the latest statistics of the cement trade. Still fuller tables are given in the third edition of the "Directory of American Cement Industries" ($5) which is now ready for delivery. The accompanying tables taken from that volume, which are based on similar tables in United States Government reports, show the distribution of the cement industry among the States of the Union and the imports for a series of years.

The tensile and compressive strengths of mortar and concrete vary so much with the kinds of cement used, the character and condition of sand, gravel and stone, the care used in making the mix- the following figures may be given as fair values for the tensile strength of mortars of the proportions named.

TENSILE STRENGTH OF CEMENT MORTAR.

In pounds per square inch.

Age of Briquette.	7da.	28 da.	6 mo.
1 cement 2 sand	125	150	245
1 cement 3 sand	90	110	175
1 cement 4 sand	75	80	130
1 cement 5 sand	60	60	110
1 cement 6 sand		35	90

The average compressive strength of concrete made of 1 cement 2 sand and 4 broken stone is about as follows:

6 days old, 1084 pounds a square inch.
11to13 days old, 1676 pounds a square inch.
19to20 days old, 2040 pounds a square inch.
52 days old, 3604 pounds a square inch.
85 days old, 4256 pounds a square inch.

Reference may also be made to the table of strength and cost of concrete of different compositions in vol. xxvi, p. 184, and to the strength of concrete in compression on p. 189, both in the number of Municipal Engineering for March, 1904.

THE BEST CONCRETE BUILDING BLOCK.

We are interested in the question of concrete building block machines and will purchase some make of block machine in the near future for making artificial stone. We want to start in the business right. We want to get the best machine, one that will make the best stone and give best results and most profit out of the business. Any information or assistance you can give us in making selection of our artificial stone-making outfit will be highly appreciated.

Monett, Mo.

It is not possible for one unfamiliar with the local conditions or who has not had experience with all the machines and processes for making concrete blocks and artificial stone to make a choice for a particular business. The development of machines is so rapid that it would require all the time of a large block factory to test them all upon a commercial scale. There are some principles upon which the choice of machines and the establishment of an artificial stone business should be

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DISTRIBUTION OF MANUFACTURE OF PORTLAND CEMENT.

District.	1890			1894		
	No. of Works.	Product Barrels.	Per Cent.	No. of Works.	Product Barrels.	Per Cent.
New York	4	65,000	19.4	4	117,275	14.7
Lehigh & Northampton Co's., Pa., and Warren Co., N. J.	5	201,000	60.0	7	485,329	60.8
Ohio	2	22,000	6.5	4	80,653	10.1
Michigan						
All other sections	5	47,500	14.1	9	115,500	14.4
Total	16	335,500	100.0	24	798,757	100.00

District.	1898			1900			1902		
	No. of W's.	Product Barrels.	Per Ct.	No. of W's.	Product Barrels.	Per Ct.	No. of W's.	Product Barrels.	Per Ct.
New York	7	554,358	15.0	8	465,832	5.5	10	1,156,807	6.8
Lehigh & Northampton Co's., Pa., and Warren Co., N. J.	9	2,674,304	72.4	15	6,153,629	72.6	17	10,829,922	62.8
Ohio	6	265,872	7.2	6	534,215	6.3	7	568,113	3.3
Michigan				6	664,750	7.8	10	1,577,006	9.1
All other sections	9	197,750	5.4	15	663,594	7.8	21	3,103,796	18.0
Total	31	3,692,284	100.0	50	8,482,020	100.0	65	17,230,644	100.0

PRODUCTION OF PORTLAND CEMENT BY STATES.

State.	1901			1902		
	No. of Works.	Product Barrels.	Value, not including packages.	No. of Works.	Product Barrels.	Value, not including packages.
Alabama				1		
Arkansas	1			1		
California	*1	146,848	$513,968	§2	294,156	$431,910
Colorado	†1	585,000	643,500	2	82,044	105,016
Georgia				1		
Illinois	4	528,925	581,818	4	767,781	977,541
Indiana	2	218,402	240,242	3	536,706	628,244
Kansas	1			†1	830,050	1,017,824
Michigan	10	1,025,718	1,128,290	10	1,577,006	2,134,396
Missouri				1		
New Jersey	3	1,612,000	1,450,800	2	2,152,158	2,568,355
New York	7	617,228	617,228	10	1,156,807	1,521,553
North Dakota	1					
Ohio	§7	689,852	758,837	7	568,113	685,571
Pennsylvania	13	7,091,500	6,382,350	15	8,770,454	10,130,432
South Dakota	1			1		
Texas	¶2	195,752	215,327	2	165,500	234,950
Utah	1			1		
Virginia	1			*1	334,869	433,286
Total	56	12,711,225	12,532,360	65	17,230,644	20,864,078

*Includes Utah.
†Includes Kansas.
§Includes Virginia.
¶Includes South Dakota.

*Includes Alabama and Georgia.
†Includes Kansas and South Dakota.
§Includes Utah.

IMPORTS OF HYDRAULIC CEMENT INTO THE UNITED STATES IN 1898, 1899, 1900, 1901, 1902 AND 1903, BY COUNTRIES.

Country.	1898	1899	1900	1901	1902	1903
	Barrels.	Barrels.	Barrels.	Barrels.	Barrels.	Barrels.
United Kingdom	241,168	199,633	267,921	37,890	79,087	146,994
Belgium	651,204	624,149	826,289	303,180	615,798	737,576
France	17,294	15,049	32,710	11,771	14,922	14,866
Germany	1,032,429	1,193,822	1,155,550	560,596	1,259,265	1,377,414
Other European countries	51,582	68,348	75,827	19,077	17,956	27,415
British North America	4,635	4,398	4,517	6,066	8,611	4,420
Other countries	15,476	2,389	23,869	6,808	4,153	9,264
Total	2,013,818	2,108,388	2,386,683	939,330	1,994,787	2,317,950

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MUNICIPAL MATTERS IN COURT

Higher Courts—Mechanics' Lien on Water Company—Dam vs. Navigation—Special Sprinkling Tax—Paving Ordinance—Collecting on Invalid Contract—Approval of Contracts by Council—Front Foot Rule.

Recent Decisions in the Higher Courts on Matter of Interest to Municipalities.

Prepared by Russell T. Byers LL. B., Indianapolis.

Acceptance of Work by City—Assessments—A property owner can not escape payment of a public improvement, on the ground that the contract has not been complied with, after such improvement has been accepted by the city. Baldrick et al. vs. Gast et al. 79 S. W. Rep. (Ky.) 212.

Assessments — Apportionment—A railroad right of way is liable to be assessed for a street assessment. The city was not liable for interest under an invalid apportionment. Orth et al., vs. Park & Co. Park & Co., vs, City of Louisville. 79 S. W. Rep. (Ky.) 206.

Assessment for Improving One Side of Street—Under the statute cenferring power upon the trustees of cities to do all necessary work on streets and to assess the cost against abutting property, an ordinance providing for the improvement of one side of street and assessing the cost against the property abutting thereon is void. Town of Central Covington vs. Busse, Dressman vs. same. 80 S. W. Rep. (Ky.) 210.

Definite Description of Character of Improvement—A recommendation for a "cement walk" is sufficient to support an ordinance based thereon, providing for a cinder-cement concrete, torpedo sand and limestone walk. Storrs et al. vs. City of Chicago, 79 N. W. Rep. (Ill.) 347.

Assessments—Invalid Assessment—Reassessment—Where an original assessment for a public improvement is void, a reassessment may be made, and the fact that the property has been paid by the entire district, previously created, according to area is not unconstitutional, because depriving a person of his property without due process of law. A protest held not unqualified. The fact that the description of only one-half of the lot was included in the resolution creating the assessment district, does not prevent the assessment of the entire lot. McMillan vs. City of Butte, 76 Pac. Rep. (Mon.) 203.

Liability of Rear Lots for Street Assessment. — When the lot adjacent to the improved street is only 50 feet deep, the lien of the city and contractor attaches to the real estate in the rear of said lot to the distance of 150 feet from the street improved and the owners of such real estate may appear at the hearing on the question of special benefits. The lien attaches primarily to the lot adjacent to the street and it must be sold to satisfy such lien before the property to the rear may be sold. Vories vs. Pittsburg Plate Glass Co., 79 N. E. Rep. (Ind.) 249.

Second Ordinance for Contracted Improvement Is Unreasonable—An ordinance providing for the paving of Halsted-st. and its intersections with other streets and repealing all inconsistent ordinances is unreasonable and void when such prior ordinances provided for the improvement of the same intersections, and the contract for one of them had already been let. Chicago Union Traction Company vs. City of Chicago. 70 N. E. Rep. (Ill.) 234.

Street Improvements, Invalid Assessment—Reassessment—Where an original

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Street Paving—Assessments, Validity—It is necessary to include in the resolution providing for bringing a street to grade a description of the work necessary. A failure to include such description renders void any tax bills issued against the abutting property-owners for such improvements. Failure to use the kind of material required is held to void tax bill. Kansas City ex rel. Neill vs. Askew. 79 S. W. Rep. (Mo.), 483.

No Power to Levy Tax for Bridge not on Highway—Before a city can make a contract which involves taxation, it must have the power to levy and collect a tax for that purpose. A city may levy a tax only for corporate purposes. It has no right to levy a tax to raise funds for the purpose of building a bridge not on a street or highway. Manning vs| City of Devil's Lake. 99 N. W. Rep. (N. D.) 51.

New Plan at Less Cost Not Subject to Rehearing—Where the scheme of the improvement is changed, no further public hearing is necessary when the report of the engineer shows the estimated cost of the changed plan is less than the cost of the original scheme. City of Chicago vs. W. D. Kerfoot & Co., 79 N. E. Rep. (Ill|) 349.

Improvements—Setting Aside Assessment—Even though a petition for a street improvement was not signed by enough to give the council jurisdiction to act in the premises, where one has knowledge of the improvement, which was actually made, and made no objection to the improvement, equity will not set aside an assessment for such improvement, when the benefit equals the assessment. Farr vs. City of Detroit. 99 N. W. Rep. (Mich.) 19.

Contract Without Valid Petition Is Void.— Where no petition was filed by the owners of two-thirds of the front feet of property abutting upon a contemplated improvement, the ordinance providing for such improvement is void. Any contract entered into under such ordinance was unenforceable. City of Covington vs. Brinckman. 79 S. W. Rep. (Ky.) 324.

Streets Under Control of Legislature—Streets, alleys and other highways are under the control of the Legislature. Its power is limited only by the constitution. City of Laporte vs. Elm & Co. 76 Pac. Rep. (Kas.) 448.

Benefit by Improvement—Taxing Districts—The Legislature has power to create special taxing districts and to assess benefits for local improvements to property therein, according to valuation, area or frontage. Article 10 of the State Constitution, relating to uniform taxation, is not applicable to the laying of special assessments. The owner of property may not contend that his property has not been in fact benefitted to the amount of the special assessment, where taxing districts have been properly created and the cost of the improvement has been duly apportioned. Meier vs. City of St. Louis, 79. S. W. Rep (Mo.) 955.

Work Must be Described. Time of Completion—A city of the fourth class must describe the work necessary to bring the street to the established grade in the resolution providing for the improvement. If this be not done tax bills issued against the abutting property for such improvement are void. The council may advertise for bids before the ordinance has been passed, where the resolution is regular. Where time is an essential element in an improvement contract the city council has no right to waive a default of the contractor in that regard. Smith vs. City of Westport, 79 S. W. Rep (Mo.) 725.

Dual Water Works—Ballot Is Illegal—A ballot submitting to the voters of a city of the first class a proposition to issue bonds "to purchase, procure, provide, or contract for the construction of water works" is illegal because dual, hence void. City of Leavenworth vs Wilson, 76 Pac. Rep. (Kans.), 400.

Water Company Subject to Mechanics' Lien.

A decision rendered by Judge Leathers of the Superior Court at Indianapolis, Ind., holds that an attachment on a mechanic's lien can be enforced against corporations of the quasi-public character of the Indianapolis Water Company. The Indiana mechanic's lien law gives laborers and materialmen the right to attach a lien on a system of water works. The decision was handed down in the case of Charles E. and Ora D. Shover against the Sand Filtration Company, the Indianapolis Water Company and others for judgment on a lien held against the Sand Filtration Company for $7,000. The plaintiffs are the contractors who had charge of the filtration company's work for the water company when the new plant was built. While the part of the water company in the suit was merely nominal, it was necessary to decide the question concerning its liability in a mechanic's lien suit before the case could be heard. It had been contended that the system of

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the Indianapolis Water Company was of such a public nature that a lien enforced against it would work a hardship on the public in the event of its being sold to satisfy the lien. Judge Leathers overruled a petition of the defendants to remove the case to the United States Court on the ground that certain members of the filtration company are residents of New Jersey. He held that the records do not show that the corporation includes non-residents.

Dam an Obstruction to Navigation.

The Supreme Court of the State of South Carolina refused the mandamus asked for in the case of certain citizens against the new water-works company, at Charleston, S. C., asking that the company maintain a waterway and keep Goose Creek open to navigation. Goose Creek is a navigable stream in Berkeley county, across which the water-works company placed a dam extending from bank to bank, thereby closing it to all vessels. Demands were made by relators who are riparian owners of the lands on each side of the creek for some distance above the dam, upon the respondent to remove so much of the dam as is essential to the navigation of the waters of the creek.

Chief Justice Pope, in his decision says that any remedy, is not theirs specially, but that of the general public.

There is another view presented by the respondent, that the failure of the respondent to have a lock inserted in the dam so as to allow full navigation of the waters of Goose Creek, is but a temporary condition. The respondents had a lock inserted in their dam, but being defectively constructed, although approved by the United States Government, it failed to give the public the advantage which was expected from it, and a new lock is being constructed as expeditiously as the respondent can do so. So this case does not fall within the rule to govern permanent obstructions, but on the contrary, belongs to that class of cases such as obstructions in the highway, where material is placed in said highway in order to have a building erected alongside of the highway.

Ordinance Must State Kind of Pavement Proposed.

prevent its improvement by paving, the City Council must state in its resolution calling for bids what kind of pavement is to be laid. A contract at Bluffton, Ind., where the resolution called for bids on asphalt, brick or macadam pavements and the Council undertook to decide after the bids were received what kind of pavement should be laid, was held to be void, so that the contractor could be enjoined from proceeding under it.

Louisville Must Levy Special Sprinkling Tax.

In an opinion handed down by Judge Shackleford Miller, May 5. he sustained the motion of James H. Button for an injunction against the city of Louisville to prohibit the appropriation of $15,000 from the general purpose fund of the last tax levy, for street sprinkling during the months of June, July and August. Judge Miller held that if the General Council be allowed to convert to any of the fifteen specified objects of special tax levy any portion of the general purpose fund, the entire object of the charter, which requires that items of tax levy shall not be converted to other objects, would be defeated. This requirement, said Judge Miller, is to guard agaist the arbitrary appropriation of funds, and must be kept unimpaired. Suit was filed by James H. Button recently, to enjoin the proposed use of $15,000 for sprinkling from the general purpose fund, suing as a taxpayer who had an interest in the uses to which his taxes were put. He alleged that street sprinkling was included in the fifteen items for which the charter provided that a special levy must be made each year. This was not done, and a measure was suggested in the lower board of the General Council, providing for an appropriation from the general purpose fund. The measure was referred back to the finance committee. This was as far as the matter had gotten when the motion was made before Judge Miller by the attorney. The measure has since passed the lower board.

In his opinion, Judge Miller says:

Under section 2981, Kentucky Statutes, the sprinkling of streets is one of the fifteen specified purposes for which the defendant may levy a tax; and when levied for that purpose it can not be used for any of the other purposes. Kentucky Statutes, 2980. The city may and has

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seems to me that the 'general purposes' for which a levy may be made are those purposes only which are of a public municipal nature, and not of the specific purposes for which a separate levy may be made by the General Council. If the city can, under the charter above quoted apply a part of the 'general purpose' fund to any one of the other specific purposes, then there is no necessity of specifying any particular purpose, but the whole levy of $1.86 may be levied for 'general purposes' and applied at the pleasure of the General Council to any specified purpose. It was precisely this practice that the charter was intended to guard against. Demurrer to petition will be overruled and motion for injunction will be sustained.

Duluth Property Owners Not Relieved from Invalid Contract.

A decision was rendered by Judge Dibell May 3, at Duluth, Minn., holding that the contract under which the Barber Asphalt Paving Company paved Superior-st., from Eighth to Sixteenth-aves. east, last summer, was invalid, and that the action of the City Council in allowing some of the property owners to pay their assessments in advance in order to raise the sum necessary to let the contract was an irregular and illegal proceeding and that the resolution of the Council was in the nature of an amendment to the city charter. The property owners petitioned for an injunction asking that the city of Duluth and the city officials be restrained from paying the Barber Asphalt Paving Company the balance unpaid, but this is denied by Judge Dibell, who holds that the property owners should be denied the relief asked for owing to their delay in starting proceedings after they had ample time to know that the city was about to enter into a contract with the paving company; also the fact that during the pendency of the injunction action they had invoked a legal remedy through the city's appeal.

Louisville Council Need Not Approve Contracts.

The Court of Appeals handed down a decision recently at Louisville, Ky., in the case of the board of public works against the city of Louisville, holding that contracts for original construction of streets need not be approved by the General Council, and sustaining the lower court in its decision. The board was directed to allow the Selvage Construction Company to proceed at once with the work which was awarded. The total contracts were about $27,000.

The Selvage Construction Company was awarded contracts for the original construction of a number of blocks of streets with vitrified brick. The board of public works approved the bond of the company and then sent the contracts to the General Council for approval. It objected to the bond furnished, on the ground that the man making the bond was not a resident of Louisville. The city attorney held that in contracts for original construction, the cost being paid by the property-owners direct, the approval of the General Council is not necessary. A friendly suit was instituted for the purpose of testing the question. The decision settles the right and power of the General Council to refuse contracts for original street work because of any defect in the contracts themselves or in the bond which is given. It has been customary for several years to send all contracts for all kinds of street work to the General Council for approval, this being considered necessary to make the contracts legal. See the Southwestern Reports, vol. 79, p. 1182, for the full decision

Alabama Supreme Court on Front Foot Rule.

Chief Justice McClellan of the Alabama Supreme Court handed down a decision, May 10, in the "Baby Bond" case of Montgomery, Ala. The title of the case is the city council of Montgomery vs. Ella Moore, appeal from Montgomery city court. It arose from the provisions of section 4 of an act to authorize the city council to issue bonds for paving and otherwise improving the streets and sidewalks, or either, of Montgomery. Section 4 is as follows:

That said City Council shall provide and require, by proper ordinance, that the cost of such paving, together with the expense incident to the issue of such bonds, and the interest thereon shall be assessed against and collected from the owners of the property abutting such paving in such manner that one-twentieth thereof shall be paid each year, such assessment to be prorated according to the frontage of such property and collected at the same time and in the same manner as city taxes, and shall be a lien upon such property subordinate only to the State and city taxes.

The case involves the question whether the foregoing provisions of section 4 of the act are covered by the title of the act, that is, whether these provisions for the raising of funds with which to pay the principal and interest of the bonds, which it is the purpose of the act

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as expressed in its title to authorize the city to issue, are germane, cognate and complementary to the purpose so expressed. This inquiry must be determined affirmatively.

The other question rests on the provision for the assessment of the whole cost of the paving against abutting property, "prorated according to the frontage of such property," and is whether, in view of State and Federal Constitutional provisions as to compensation for property taken for public uses and depriving the citizen of property without due process of law, it is within legislative competency to thus impose the costs of street paving and the like upon abutting property without judicial ascertainment of the benefits accruing to such property from such improvements, and apportionament of the costs of the betterments according to and not in excess of the actual benefits inuring from them to the several abutting lots of land.

The court says:

The question has been thrashed over in numerous decisions of the courts, and, while the cases are not uniform upon it, the better view and that supported by the great weight of authority is that it is a matter of legislative expediency and for legislative determination whether abutting urban property will be benefited to the extent of the costs of a given improvement of the street or sidewalks along its front and therefore entirely within legislative competency to impose such cost, by way of special tax, upon the property abutting the improved street, apportioning the charge thereto according to the distance the several parcels of land front upon the street. The authorities supporting this view are numerous and include, we believe, all text writers on the subject: "The major part of the cost of a local work," says Judge Cooley, is collected by general tax, while a smaller portion is levied upon the estates specially benefitted.

"The major part is sometimes assessed on estates benefited, while the general public is taxed the smaller portion in consideration of smaller participation in the benefits.

"The whole cost in other cases is levied on lands in the immediate vicinity of the work.

"In a constitutional point of view, either of these methods is admissible, and one may sometimes be just and another at other times. In other cases it may be deemed reasonable to make the whole cost a general charge, and levy no special assessment whatever. The question is legislative and, like all legislative questions, may be decided erroneously; but it is reasonable to expect that, specially benefited to bear the expense of local improvements is a branch of the taxing power, or included within it. * * * Whether the expense of making such improvements shall be paid out of the general treasury or be assessed upon the abutting property or other property specially benefited, and, if in the latter mode, whether the assessment shall be upon all property found to be benefited, or alone upon the abutters, according to frontage or according to the area of their lots, is according to the present weight of authority considered to be a question of legislative experiency."—2 Dillon's Municipal Corporations, Sec. 752.

These formulations of the doctrine were approved by the United States Supreme Court in French vs. Barber Asphalt Paving Company, 181 U. S. 324, 343, and they are supported by that case and many others, some of which are cited on the brief for appellant.

Judge Cooley states the same doctrine in his work on Constitutional Limitations, p 507: "It has been held equally competent for the legislature to make the street the taxing district and assess the expense of improvements upon the lots in proportion to frontage. Here also is apportionment by a rule which approximates to what is just, but which, like any other rule that can be applied, is only an approximation to absolute equity. But if in the opinion of the legislature it is a proper rule to apply in a given case, the court must enforce it."

Mr. Beach in his work on Public Corporations, states the doctrine as follows: "Section 1,072. It is well settled that the power to make a public improvement on the part of a municipal corporation and to impose the burden of the same upon the owners of property benefited thereby is one which legislature may confer upon such corporations as a part of the taxing power belonging to the State. This power of taxation and of apportioning taxation are identical and inseparable. Taxes cannot be levied without apportionment; and the power of apportionment is therefore unlimited, unless it be restrained as a part of the power of taxation. There is not generally in our States any restraint upon it. It is competent for the legislature to apportion the tax generally upon all taxable persons within its jurisdiction, or within a certain district or local division; or it may apportion the tax according to the benefit which each taxpayer is supposed to receive from the object on which the tax is expended. Whether or not one mode or the other is the more equitable, the legislature is the sole and exclusive judge. It is wholly a matter of legislative discretion which method shall be adopted, and it is not at all a matter for judicial inquisition or re-

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vital, as in ordinary cases of taxation under the constitution."

And again: "Section 1175. Where land is to be taken for a public use, the Legislature is the exclusive judge of the amount of land and of the estate therein which the public end to be subserved requires to be taken. It is, therefore, competent for the Legislature to authorize a municipal corporation to condemn the title in fee-simple of land for public streets. But the title which the corporation acquires in such case is what may be termed a "qualified or terminable fee" for street purposes only, and which it holds not as proprietor but as an agency of the State in trust for the public for street purposes, and which it can neither sell nor devote to a private use. It was urged in a case where the fee-simple in land had been condemned for street purposes that as assessments for benefits could only be made for local improvements, and as it was only necessary to take an easement in land for street purposes, therefore, the taking the fee was not for a local improvement; consequently, if taken, no assessments could be levied to pay for it. To this the Supreme Court of Minnesota said: 'The Legislature having authorized, as it might, the condemnation of the fee for the purpose of opening or widening a street, which is a local improvement, payment for the land taken in fee for that purpose is as much a part of the cost of the improvement as would have been payment for an easement had that been the interest taken."

Judson on Taxation has a luminous treatise on the subject, in line with the texts we have quoted and fully sustaining not only legislative competency to assess the cost of street and other like improvements against abutting property, apportioning it by frontage,, but the practical expediency and general fairness, and the conclusiveness of such assessment. Section 355, et. seq. We quote one or two passages: "While a few States still insist that the apportionment must be made according to a determination of special benefits in each case (that is in respect to each parcel of property we suppose) the trend of authority has been overwhelmingly in support of the rule that a legislative apportionment by frontage or area is allowed. Thus it was said by Judge Cooley in the Supreme Court of Michigan in 1881: "We might fill pages with the names of cases decided in other States which have sustained assessments for improving streets though the apportionment of cost was made on the same basis (according to frontage) as the one before us. If anything can be regarded as settled in municipal law in this country, the power of the Legislature to permit such assessments and direct an apportionment of the cost by frontage, should by this time be considered as no longer open to controversy. Writers on constitutional law, on municipal law and on the law of taxation have collected the cases, and if the question were new in this State we might think it important to refer to what they say. But the question is not new; it was settled for us thirty years ago. Sheley vs. Detroit. 45 Mich., 431. Sec. 367."

This author further says: "The apportionment of the cost of a public improvement by a definite rule, as by frontage or area in the taxing district, has been held necessarily to exclude evidence of the want of special benefits in the enforcement of assessments upon the property as the legislative determination in ordering the assessment upon that basis presumptively involves the finding that the property is benefited to the extent of the assessment. This conclusiveness of the legislative decision in the formation of taxing districts is said, therefore, to rest upon the presumption that the Legislature proceeds upon investigation and inquiry, and decides what the public good requires; that it only creates a taxing district and charges the expense of a public improvement upon it when satisfied that the property therein will be specially benefited by the improvement. The courts, in sustaining this doctrine of legislative conclusiveness, recognize that its real basis is the impracticability of making any satisfactory judicial apportionment of the benefits from such improvements as between the abutting property and the general public. In the language of the Supreme Court of North Dakota: 'How could the courts ever determine what part should be paid out of the general treasury and what part raised by local assessment? What rule would govern them in investigating such a question? And what right have they to dictate where the line shall be drawn?"

This court put itself in harmony with the doctrine of the foregoing texts and decisions in the case of Mayor and Aldermen of Birmingham vs. Klein, 89 Ala., 561, decided in 1889; and has so remained, if we leave out of view some wabbling in dicta superinduced by what three of the judges of the Supreme Court of the United States yet believe was the effect of that court's decision in the case of Norwood vs. Baker, 172 U. S. 269.

In that case Mayor and Aldermen, etc., vs. Klein, this court sustained as a constitutional and valid enactment a statute which authorized the corporate authorities of Birmingham to grade and pave the sidewalks along the streets of the city, and to assess the total cost thereof, although it might be greatly in excess of the value of the benefits to abutting property. It is true that this cost was to be assessed on this property "in proportion to the amount of the benefit accruing to the" property owners; but this only meant that there should be some rule of apportionment of the whole charge having reference to the benefit received by the respective owners and not that no owner should be charged in excess of actual benefits received. The

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provision would have been fully complied with through an apportionment according to frontage on the sidewalk of the respective abutting lots, and so the act was construed in the opinion.

In the case of City Council of Montgomery vs. Birdsong, 126 Ala., 632, it was decided that the charter of Montgomery giving power to the city to impose cost of street improvement upon abutting property provided for the assessment against each parcel of land in proportion to and not in excess of the actual benefit accruing to each parcel. It was assumed rather than decided that such rule of assessment was essential to the validity of the act, and this upon the notion that such was the effect of the decision in Norwood vs. Baker, supra; and something was said in the course of the opinion to the effect that the supposed holding in that case that such cost could not be laid against abutting lots irrespective of the actual benefit to each lot, appeared to be "consonant with reason and authority." This assumption and this dictum were the product of what is now said by the Supreme Court of the United States to be a misconception of the Norwood-Baker case; for it has since been decided by that court that it is entirely competent for the Legislature of a State to lay the cost of street paving and the like against abutting property, and to apportion the charge according to the frontage of each lot on the street, and it was said that the decision in Norwood vs. Baker should be confined to the particular facts of the case, and that so considered, that case was not inconsistent with the general doctrine that the cost of street improvements may be laid wholly upon abutting property by frontage. French & Barber Asphalt Paving Co., 181 U. S. 324. Nothing was decided in the Birdsong case inconsistent with the prevailing doctrine as to legislative competency in this connection, and we feel less constraint toward following the assumption and dictum indulged in that case for the reason that their indulgence is referable to a natural misconception of the Norwood-Baker case, if it were a misconception, or, if not, then to a case —Norwood v. Baker—which has since been qualified so far as it originally bore upon the question now before us. The subsequent case of City Council of Montgomery v. Foster, 133 Ala. 587, but followed the Birdsong case in the construction of the charter of Montgomery, and nothing is therein decided established general doctrine of legislative competency to enact laws such as the statute involved in this case. We are thoroughly satisfied of the abstract soundness of that doctrine, and we now reaffirm it, and hold that the statute before us, authorizing the imposition of the entire cost of certain street or sidewalk paving upon abutting property "prorated according to the frontage of such property," was a constitutional and valid enactment.

The City Court in reaching the contrary conclusion was doubtless misled by the Norwood-Baker case, and by what this court said in the Birdsong case, being ourselves misled thereto by the Norwood-Baker case. Its decree must be reversed. The cause will be remanded.

CEMENT AND CONCRETE

Concrete Mine Shaft—English Artificial Stone—Tests of Concrete Block and Brick—Price of Cement—Tests of Steel-Concrete Beams—The Milford Concrete Standpipe.

Concrete for Lining Mine Shafts.

Many shafts in the coal regions of Pennsylvania are lined with concrete. One of the largest of these is the Grassy Island shaft of the Delaware & Hudson Company, near Olyphant. It will be nearly 800 feet deep and the concrete lining extends through the upper soft strata and

The outside dimensions of the Grassy Island shaft, as far down as concrete lining was to be used, were 58 by 20 feet, the concrete being about 4 ft. thick.

The concrete used is made of five parts of coarsely broken sandstone or grit, from a nearby rock dump. The rock is broken by a Blake crusher to about a 3-inch ring.

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mixed by hand labor with the Portland cement and sand, these having been previously mixed, also by hand labor, in a mixing box. Especial care was taken to mix the concrete pretty dry, that is, simply moist, not wet, this being necessary for the best results.

When mixed, the concrete was shoveled down chutes so arranged as to deposit the concrete near where it was needed. This use of chutes has been criticized by some engineers, who claim that concrete should be either mixed on a temporary platform in the shaft, and shoveled off this platform into the space between the rock and planking, or, if mixed on the surface, should be lowered in buckets, because of the well-known tendency of rock and mortar to separate when sliding down a chute. However, in this case, the contractors used chutes with an elbow near the bottom, and by this elbow the rock and mortar were still well mixed when they fell on the platform. The cement was shoveled into the space between the rock wall and the planks, and well tamped as fast as put in, thorough tamping being absolutely essential to a tight and durable lining.

Before concreting began, the rock walls of the shaft had been thoroughly cleaned by a stream of water under a head of 100 feet or more. This removed all slime and ooze, and also many loose pieces of rock. To keep water from accumulating behind the concrete, and, under pressure, eating its way through while the concrete was still green, making a leaky job, pieces of 1-inch pipe were put in at intervals where the flow is heaviest. When the concrete had set, the pipes were plugged first with waste soaked in tar, then with good cement mortar rammed in hard. As a result the lining does not show a leak.

In the temporary timbering for placing the concrete the timbers at the corners of the shaft were very heavy, 10 by 10-inch. Intermediate timbering was lighter, 4 by 6-inch, while 2 by 12-inch planks were used for the rest of the work. Owing to the setting of the concrete, the timbering in work like this is continually getting out of place, and requires the strictest supervision. Hence, besides a good foreman, a skillful and experienced carpenter is needed to keep the alignment exact.

An English Artificial Stone.

The following description of L. P. Ford's process of making artificial stone from sand and lime is taken from a paper presented by him to the English Society of Arts. After some account of the difficulties met with in discovering the proper processes the paper proceeds as follows:

The great value of the industry lies in the following points:—

(1) The stone itself is a production of a true silicate of limestone—the old Roman mortar which has stood so many centuries.

(2) It is not a concrete made with Portland cement, and is absolutely homogeneous throughout and can, therefore, be cut up and used like—nay better than—natural stone, which has layers, vents, flaws, etc.

(3) It is better than natural stone, because few natural building stones now used will resist the acids in the atmosphere, and this stone does.

(4) Silica sand exists on over three-fourths of the earth's surface, and is, therefore, obtainable near building sites, and thus an immense saving will ensue in carriage alone.

(5) There are immense tracts of land where no natural building stone is obtainable, and therefore, where this is the case, the chance of obtaining stone by my process is a fact of immense importance.

(6) In addition the stone may be produced at about 3d. per cubic foot, a price at which natural stone cannot be quarried.

(7) The carving qualities of the stone are splendid.

(8) The crushing strength is three times greater than Portland stone, or less, if desired.

As is usual, and I may say essential, for great success, my discovery is of the simplest possible, so that any ordinary mechanic with a fair amount of brains can learn and carry out the process, which is, shortly, this:—

We use nothing else but ordinary silica sand (as most sands are) and common fat lime. The purer the sand the purer and better the stone will be, and, ordinarily, we prefer not to have more than about 3 per cent of iron and 3 per cent of alumina and no other foreign matter. But I may say here that stone can be made by us out of almost any sand and quarry refuse, but it would not always be pure silicate of limestone. In some places that would not matter, but in large cities the purer the stone the longer it will endure.

The sand we grind and grade so as to get several grades, and the lime is reduced to a very fine powder. The two ingredients, in the proportion of about 92 percent of sand to about 8 percent of lime, are mixed dry, and then run into a cylindrical mold, made in a special way and which is the key to the process. The mold is closed and placed in a boiler, from which the air is then exhausted, and into which water is immediately afterward allowed to enter and cover the mold. The temperature is gradually raised to about 150 degrees Fahr., and

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kept up for eight hours, when the process is complete. The boiler is allowed to cool, then opened and the mold removed. When cool enough the mold is relieved of its contents, which can at once be used. I call the process absurdly simple, and yet it has cost, if we reckon the thousands each attempting inventor has spent since 1832, here and abroad, £200,000, I suppose. The process is a close imitation of nature's methods, for in the bowels of the earth we find silica sand, alkalies and a high temperature, with an enormous superincumbent pressure.

In conclusion I will repeat a favorite asertion of mine, already made—namely, that when civilization creates artificial conditions, simple natural things have to be replaced by artificial products.

Price of Cement.

The last number of the Bulletin of the Bureau of Labor, gives data regarding prices of materials from which the following regarding cement are taken.

The lowest wholesale price quotations in New York City for domestic Portland cement since 1890 were from March to May, 1902, and in October, 1903, and were from $1.60 to $1.90 a barrel. The highest in April, 1900, were $2.20 to $2.35. The lowest quotation for Rosendale cement was sixty cents a barrel in November, 1898, and the highest $1.20 to $1.25 in April, 1892.

The prices of domestic cement each year from 1890 to 1901 are given in Municipal Engeering vol. xxiii, p 46. These tables may be extended by adding the average price per barrel of domestic Portland cement in New York in 1902, $1.95, and in 1903, $2.03. Rosendale cement averaged 86.5 cents a barrel in 1902 and 89 cents in 1903.

The fluctuations in price of Portland cement in 1903 are as follows:

January, 1903	$2.125 a barrel
February	2.075 a barrel
March	2.125 a barrel
April	2.150 a barrel
May	2.125 a barrel
June	2.200 a barrel
July	2.150 a barrel
August	2.000 a barrel
September	2.000 a barrel
October	1.750 a barrel
November	1.875 a barrel
December	1.775 a barrel
Average for Year	2.029 a barrel

Strength of Hollow Concrete Blocks, Cement and Sand Lime Bricks.

The accompanying table shows the result of tests of crushing and transverse strengths made by Prof. A. Marston of Iowa State College, on hollow concrete blocks, bricks of cement and sand, and Huennekes process sand-lime brick. The data were presented at the last meeting of the Iowa Engineering Society, and the following description of the methods of making the tests is taken from Mr. Marston's paper:

In general the procedure in transverse tests was to support the concrete block or brick near each end on rounded knife edges with steel bearing blocks to prevent cutting in of the knife edge and to apply the load to a similar, but adjustable knife edge and block at the midway point on top. In the crushing tests of large shapes the specimens were bedded in plaster of Paris and allowed to set four hours. In these tests and in the transverse tests the blocks were placed in the machine in the same position in which they would stand in a wall. In the transverse tests of brick the specimens were placed flatwise. The crushing tests of 2-in. cubes were made between adjustable steel bearing surfaces. In calculating the crushing tests of the large shapes, the results expressed in tons per square foot were determined without allowing for the hollows in the concrete blocks, while for the results expressed in pounds per square inch the hollows were deducted in making the computations.

The detailed tests of concrete blocks given in the table may be summarized and average as follows:

Kind.	Transverse Modulus of Rupture, lbs. per sq. in.	Crushing strength. Large shapes Tons per sq. ft.	Crushing strength. 2 inch cubes, lbs. per sq. in.
a	177	45.5*	1047
b	312	43.1*	839
c	177	42.5	1113
Average	222	43.7	996

In connection with this summary, caution should be given, first, that the number of tests is not great enough for reliable averages, and, second, that the blocks were of different ages, and that probably none of them were old enough to attain their full strength. In spite of

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Iowa Brick and Tile Manufacturers' Association at the 1902 meeting, and with the tests of Iowa common brick which he reported at the 1903 meetings.

Summary of Tests of Common Brick and of Hollow Building Blocks.

Kind.	Crushing Strength. Transverse Modulus of Rupture, lbs. per sq. in.	Large shapes Tons per sq. ft.	2 inch cubes, lbs. per sq. inch
Average of four Mason City hollow blocks..	...	54.8	...
Average of 6 varieties of Common Brick....	660	....	3370
Average of 3 Varieties of Soft Brick.....	300	....	1850

It would appear from the results of these tests that the crushing strength of concrete hollow blocks is ample for the loads which would be apt to be placed upon them in ordinary buildings. The material itself, as compared with brick, does not appear to be as strong, as regards either crushing or transverse pressures.

Cement brick behaved very much like the material of concrete blocks in the tests. The sand-lime brick tested was considerably stronger, but did not test as good as common brick.

Tests of Steel Concrete Beams.

Two sets of experiments on concrete beams reinforced with metal have recently been made and reported to the Western Society of Engineers by Prof.

RESULTS OF TESTS OF LIME-SAND AND CEMENT-SAND BRICKS AND CONCRETE BLOCKS.

Civil Engineering Department, Iowa State College, January, 1904.

Specimen.	Proportion.	Approx. Age. Mo.	City.	Number.	Size.	Crushing Test. Large Shapes. Tons per sq. ft.	Large Shapes. lbs. per sq. in.	2 in. Cubes. lbs. per sq. in.	Transverse Test. Total Load. lbs.	Modulus of Rupture lbs. per sq. in.
Cement Sand Brick.	1-8	.....	Waterloo	1	4.06"x2.25"	.....	.....	660	850	373
" "	1-8	.....	"	2	4.00"x2.25"	.....	.....	727	835	371
" "	1-5	.....	"	3	4.05"x2.27"	.....	.....	590	980	401
" "	1-3	.....	"	4	4.09"x2.25"	.....	.....	570	710	309
" "	1-4	.....	"	5	4.05"x2.55"	.....	.....	1809	790	347
" "	1-4	.....	"	6	4.13"x2.30'	.....	.....	1084	650	267
Concrete Blocks.	1-5	4.5	"	1b	10"x9" x2' 6¼"	*48.0	880	974	5940	426
"	1-5	4.5	"	2b	10"x9" x2' 6"	28.5	570	1145	4050	328
"	1-5	4.5	"	3b	10"x9" x2' 8"	*48.0	939	859	3330	260
"	1-5	4.5	"	4b	10"x9" x2' 6"	*48.0	931	337	3060	235
"	1-4	1.7	Sac City	1a	8"x9" x1' 3¾"	.....	.....	1417	4300	196
"	1-4	1.7	"	2a	10"x9" x1' 3¾"	.....	.....	967	4600	158
"	1-4	1.7	"	3a	8"x9" x1' 4"	45.8	899	800	.....	.....
"	1-4	1.7	"	4a	8"x9" x1' 3¾"	*48.8	963	815	.....	.....
"	1-4	1.7	"	5a	8"x9" x1' 3¾"	41.9	841	1236	.....	.....
"	....	6.0	Webster City	1c	10"x9" x2' 7¾"	45.0	822	1430	1365	105
"	....	6.0	"	2c	8"x9" x2' 7¾"	35.8	683	1270	1580	160
"	....	6.0	"	3c	10"x9" x1' 3¾"	.....	.....	1250	3680	111
"	....	6.0	"	4c	8"x9" x1' 3¾"	.....	.....	990	7440	330
"	....	6.0	"	5c	8"x9" x1' 3¾"	48.7	950	930	.....	.....
"	....	6.0	"	6c	10"x9" x1' 4"	40.5	778	806	.....	.....
Sand Lime				1	2⅝"x4"	.....	.....	2097	1600	685

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W. K. Hatt of Purdue University and Prof. M. A. Howe of Rose Polytechnic Institute.

The beams used by Prof. Hatt were mainly of 1-2-4 concrete reinforced with plain wrought iron bars. Those used by Prof. Howe were about the same composition, but corrugated iron bars were used instead of plain ones, with a reinforcement of from .52 to .65 of one per cent. Prof. Hatt says: "In the writer's tests of stone concrete beams reinforced with wrought iron whose elastic limit was 36,000 pounds per square inch, a two per cent. reinforcement failed to develop the compressive strength of the concrete."

The beams used by Prof. Howe were in the proportions of 1 cement to 7 of sand and stone and the corrugated bars used showed an elastic limit of 60,000 pounds and an ultimate strength of 100,000 pounds. They failed in compression or shear, showing that the proportion of steel reinforcement was sufficient for the tension stresses. From the experiments the maximum compression in the concrete was computed by the common theory for the load when failure began. It varied from 1,750 to 3,100 pounds per square inch in the 16 beams for which it was computed. At the same time the tension in the steel was computed and varied from 52,200, in a beam 18 feet long which failed by shearing, to 76,500 in two beams 10 and 12 feet long respectively.

The Milford Concrete Standpipe.

Since the article on the concrete standpipe at Milford, O., was published in vol. xxvi, p. 162, of Municipal Engineering, the standpipe has been successfully tested, and it is now in regular service. There is a slight filtration of water through the concrete, so slight that it is scarcely noticed on a sunny day, but on cloudy days the outside of the structure shows considerable dampness. The inside will be coated with a wash of neat cement with the expectation that will effectually prevent all leakage.

ROADS AND STREETS

Preparing Asphalt for Repair Work—Oil Roads—General Asphalt Co.—New York Asphalt Specifications—Street Grade Ordinance.

Method of Preparing Asphalt for Repair Work.

A party of city officials from Chicago, consisting of F. W. Blocki, Commissioner of Public Works; M. J. Doherty, Superintendent of Streets, and John Ericson, City Engineer, visited Pittsburg, Pa., May 7 for the purpose of making a thorough examination of a new plan of preparing asphalt for paving purposes, the patent of W. C. Thoma of the Wadsworth Stone & Paving Company. The main object that Mr. Thoma has in view is to have each municipality own and control its own asphalt plant, thereby saving considerable money during the course of a year by doing its own patchwork on the streets. By his process the asphalt is cooked by steam, no fire being permitted to get near it. It is heated to a temperature of 280 to 300 degrees, and when it goes down to a temperature of 220 degrees it can still be worked, and adheres perfectly. One of the claims made for the new invention is that there is absolutely no waste in the product, as it can be heated over and over again without losing its life or elasticity.

Oil on Roads in District of Columbia.

The Commissioners of the District of Columbia have authorized the purchase of fifty barrels af asphaltic oil and 100 barrels of Texas oil, to be used on the streets of Washington and the county roads, in an experiment to determine the advisability of using oil to lay the dust on the streets and roads. The sum of $400 will be expended in making the experiment.

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The General Asphalt Company's Annual Report.

The first annual report of the reorganized asphalt trust, known as the General Asphalt Company, was made May 17, by President John M. Mack.

The total business for the year amounted to $16,907,138, and the report shows on its face a net profit of $360,226. The asphalt selling and the paving departments showed profits of $1,617,052, to which $147,881 is added as income from rents, interest, etc., and from which are deducted $420,247 interest and fixed charges, $284,831 general expenses, $185,485 reserve for bad debts and some small item to make the net profit named.

The amount of asphalt mined in 1903 was about one-third more than in 1902, being 204,340 tons, of which 181,076 tons were Trinidad Lake and 23,264 tons were Bermudez. The company refined 99,564 tons of asphalt, of which it sold 17,439 tons to others than its own subsidiary companies. The amount of paving done in 1903 was about 50 per cent greater than that done in 1902, aggregating 4,727,160 square yards. The company has contracts for 1,022,632 square yards for execution in 1904.

The gross business of paving amounted to $8,996,133, on which there was a net loss of $106,761. The general contracting and miscellaneous private work of the company aggregated $2,975,980, on which there was a net profit of $81,241. The profits on asphalt refining and selling were $1,598,785.

In analyzing the figures of the report the Philadelphia North American calls attention to an item of "special expenditure of $272,120.62 for improvement of pavements in 1903" which seems to have been paid out in maintaining pavements under old guarantees. If this is deducted from the net profit given above it makes the real profits $588,105 for a period of 13 months ending April 30, 1904. It would seem that this maintenance charge should have been included in the operating expenses, thus reducing the book statement of net profits to the figure last given.

Another item which troubles the journal referred to is one of $379,136 for "promotion" which it finds difficulty in reaching by legitimate charges for agents, solicitors and men working up petitions for street improvements.

The same journal finds corroboration of its former charges of misapplication of funds of the old trust in Venezuela in the charges of President Castro of that republic that upon his refusal to accept an offer of $500,000 for his influence the trust expended large sums in sustaining the Matos rebellion. His charges were published in Venezuelan papers nearly two months ago and it is now stated that he is about to begin legal proceedings to annul the concessions of the New York and Bermudez Company under which the asphalt is being taken from the Bermudez asphalt lake.

The officers elected by the board of directors of the General Asphalt Company to serve for the fiscal year are: John M. Mack, president; Gen. Avery D. Andrews and A. W. Sewall, vice-presidents; Clyde Brown, treasurer; J. L. Rake, general agent; H. R. Wardell, general sales agent, and R. J. Wortendyke.

The General Asphalt Company has consolidated operations into about one half dozen companies. The principal ones are as follows: The New Trinidad Lake Asphalt Company lessee of the principal supplies of Trinidad asphalt on the Island of Trinidad, British West Indies; The New York and Bermudez Company, lessee of the Bermudez asphalt deposit in Eastern Venezuela; The Barber Asphalt Paving Company, laying pavements in the cities of the United States; The South American Asphalt Paving Company, laying pavements in two or three South American cities.

The appraised value of the combined real estate is $1,310,288 and plants, $1,746,582. The principal refinery is near New York in New Jersey. The debts of the underlying companies are:

Trinidad Company	$1,749,395
Barber Company	889,100
N. Y. & B. Company	250,000
Total	$2,888,425

The liquidation of the National Contracting Company and a few others is continued as fast as circumstances permit. The South American Company took no new contracts and ran at a loss. It is probable that the debt of about $3,000,000, will have to be earned and paid before any dividend can be declared on the capitalization of about $30,000,000 par value of preferred and common stock. The preferred stock is quoted now at about 30 and the common at 10; par being 100.

The principal competition is from Western Venezuela, Mexico and California.

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Changes in Asphalt Specifications for New York City.

One of our special correspondents in New York City states that the Board of Estimate and Apportionment of the city of New York on May 20, after an investigation of several weeks with the assistance of its engineers and J. W. Howard as Consulting Engineer and Asphalt Expert, decided that it would raise the requirements as to the quality of refined asphalt, etc., hereafter permitted to be used in Greater New York. This was unanimously adopted by the Board, composed of the Mayor, presidents of the five boroughs (New York, Brooklyn, Queens, Bronx and Richmond), the Comptroller and President of the Board of Aldermen. This is the highest legislative body appropriating funds for use in New York. It found that the cost of repairs of low grade asphalt such as Trinidad, etc., containing less than 56 per cent of bitumen and containing matter affected by water, had become so excessive that it was necessary to exclude low grade asphalts and require higher grades, as those from several parts of Venezuela, Mexico and elsewhere, of which there are ample supplies to be had from the same company which furnished Trinidad asphalt and from competing companies. This opens the specifications to full competition while raising the grade of asphalt required. The requirement adopted by the Board is in brief as follows:

The refined asphalt shall be homogeneous and free from water, must not be affected by the action of water, must not contain less than 90 per cent of bitumen soluble in carbon bisulphide and the bitumen shall itself be soluble to a degree of at least 68 per cent in petroleum naptha of boiling point 40 to 60 centigrade. Some minor changes were also made in the specifications.

Form of Ordinance Establishing Street Grades.

The City Council of Havre, Mont., passed an ordinance establishing street grades for the city which was prepared by the City Engineer, C. W. Swearinger. It will doubtless be of assistance to other small cities in preparing similar ordinances.

Section 1 fixes the U. S. Geological Survey bench mark as the official bench mark of the city, fully describes it and gives its elevation.

Section 2 reads as follows:

Sec. 2. That the grades of streets and avenues at the points designated is hereby established as the official grades of said streets and avenues. Said points being the block corners, respectively, at avenues and streets hereinafter named.

Curb grades at all points shall be at an elevation determined by a fall of 2½ per cent from property line grade to top of curb.

Sidewalk grades in business districts and in improved residence districts shall be determined in the following manner, viz: A rate of two and one-half per cent (2½ per cent) inclination from established grade at property line to curb grade shall determine the elevation and inclination of all sidewalks.

FIRST AVENUE.

Block corners on the—		
"	South line of Main-st	2481.89
"	North line of First-st	2482.69
"	South line of First-st.	2482.59
"	North line of Second-st	2483.59
"	South line of Second-st	2483.59
"	North line of Third-st	2485.39
"	South line of Third-st	2485.39
"	North line of Fourth-st	2489.59
"	South line of Fourth-st	2489.59

Each avenue is taken in order and elevations are prescribed in the same manner for each street intersection.

Section 3 repeals conflicting ordinances and section 4 fixes time of going into effect.

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COLVIN STREET ASPHALT PAVEMENT, ROCHESTER, N. Y.

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WATER, LIGHT AND SEWERS

Cambridge Supply—Gas vs. Electric Light—Gas Explosion in Conduit—Sewage Purification in Iowa—Tree Roots and Sewers.

Cambridge, Mass., Water Supply.

A report on the comparative cost of water to the city should it decide to enter the metropolitan water system, and of constructing the proposed pipe lines from Fresh Pond to Hobbs and Stony Brook basins, has been made to Mayor Daly by Freeman C. Coffin of the water board at Cambridge, Mass. Mr. Coffin says that the water now being supplied by the metropolitan system is being so supplied as a temporary measure, and except for the fact that Cambridge is temporarily in a precarious condition, the metropolitan water board has no authority to supply the water, unless under the condition of its entrance into the metropolitan water district. He figures the cost by both plans, entrance into the metropolitan district and the proposed construction of pipe lines and finds that the latter plan will mean a much smaller increase in the annual expenses of the city.

Advantages of Modern Gas Lighting Over Electricity.

Lighting by coal gas consisted not many years ago in a maximum of heat and a minimum of light. Very little effect was secured from the calorific capacity of the gas, and it was the boast of the electric light men that gas, burned in the gas engine to germinate power to drive a dynamo, would produce, despite the intermediate losses, a greater amount of light than could be obtained when the gas was burned in the ordinary manner. But gas lighting with modern methods is far ahead of electricity in all save convenience, and, under ordinary circumstances, health. The matter of health is not insurmountable. The economy in one year over electricity would pay for the ventilation necessary to remove the products of [illegible] At this moment electric as electric light depends on steam power for its prime mover. Gas engines will do something to reduce cost, but there can be very little doubt in the mind of any engineer that the plant required for producing the electric light is out of proportion extravagant as compared with that required for gas light.

Electricity lends itself to situations for which gas is out of the question; but for plain, straightforward lighting of rooms, workshops and public buildings it appears very doubtful whether electricity will continue to hold first place in any sense of the term. The machinery of electric light has become more complicated instead of simpler as time has moved on. Electric light engineers appear to have succumbed to this tendency without an effort, and their undertakings have been burdened with this load of complication as well as a load of duplicate plant made necessary by the hand to mouth methods which are still practically compulsory in the absence of a satisfactory system of electric storage.

In coal consumption the incandescent electric light probably demands three times as much as modern gas lighting—W. H. Booth, in Cassier's Magazine.

Gas Explosion in a Newark Conduit.

A recent explosion of illuminating gas in a conduit at the lower end of Springfield-ave., Newark, N. J., blew up a manhole and broke a large number of windows. The report of the explosion was heard for nearly a mile. It is thought to have been caused by gas escaping from a leaking main becoming ignited by electricity from a nearby conduit.

Sewage Purification in Iowa.

The City Engineering Department of [illegible] has

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RUSH STORAGE RESERVOIR, ROCHESTER, N. Y., WATER WORKS.

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1898. Since that time it has continuously purified an amount of sewage equal to that of the average town of 2,000 population. The effluent is as clear, sparkling and odorless as the purest spring water. Chemical and bacterial tests show it to be purer than some well water which is used for drinking purposes.

The subject of sewage disposal is very important in Iowa, because the cities of the State are now just beginning to put in sewers as extensively as they did waterworks during the last two decades. The college receives many requests for information, and the authorities of many Iowa towns have visited the college plant. Five bulletins have been printed relating to sewage disposal in Iowa and can be obtained on application to Prof. Marston.

The plant consists of a brick septic tank and of two filters of sand and gravel about four feet in depth. After passing through the tank the sewage is discharged on top of the filters. Tile drains underneath the filters remove the purified effluent. The plant cost only $2,500 for construction. It costs about $250 annually to maintain it. The filters last indefinitely, with some care in the way of loosening up the surface with hoes or iron rakes. The plant is successfully operated in the winter as well as in the summer. It purifies from 40,000 to 90,000 gallons of sewage per day. Experiments in the purifying of creamery sewage are now being begun on account of many requests received from the creameries of the State.

The Departments of Botany and Agricultural Chemistry have co-operated with the Civil Engineering Department in all this work.

A similar plant has been designed for Marion, Ia., but thus far it has been necessary to construct only the septic tank as further purification in filter beds has not yet proved necessary.

Preventing Tree Roots from Entering Sewers.

Engineer C. E. Moore, who is putting in a sewer system at Menlo Park, Cal., reports his method of construction which will have the effect of preventing tree roots from entering the sewers. It is very difficult to preserve perfectly tight joints, as any settlement is almost sure to cause cracks in the cement, and through these cracks the roots easily penetrate. It is well known that salt will kill tree roots, and in constructing the sewer a shovelful or two of salt is tamped around each joint. Mr. Moore is confident that this will keep out the roots for a good many years.

MUNICIPAL AND TECHNICAL LITERATURE

New Publications—Municipal Reports.

New Publications.

Proceedings of the Sixth Annual meeting of the American Society for Testing Materials, held July 1-3, 1903. Edgar Marburg, Secretary, Univ. of Pennsylvania, Philadelphia, Pa.

This society is one of the valuable working societies of the engineering profession and its volume of proceedings is of the utmost interest. The society deserves the fullest support from engineers, and the three dollars [illegible] crippled slightly by the destruction of some of the copy for it by fire, but this affects only the cement department and this but slightly.

Standard specifications for iron and steel for various purposes, cement and preservative coatings are features of this volume. There are also many papers on details of processes and tests for steel and iron for many purposes. Road ma-

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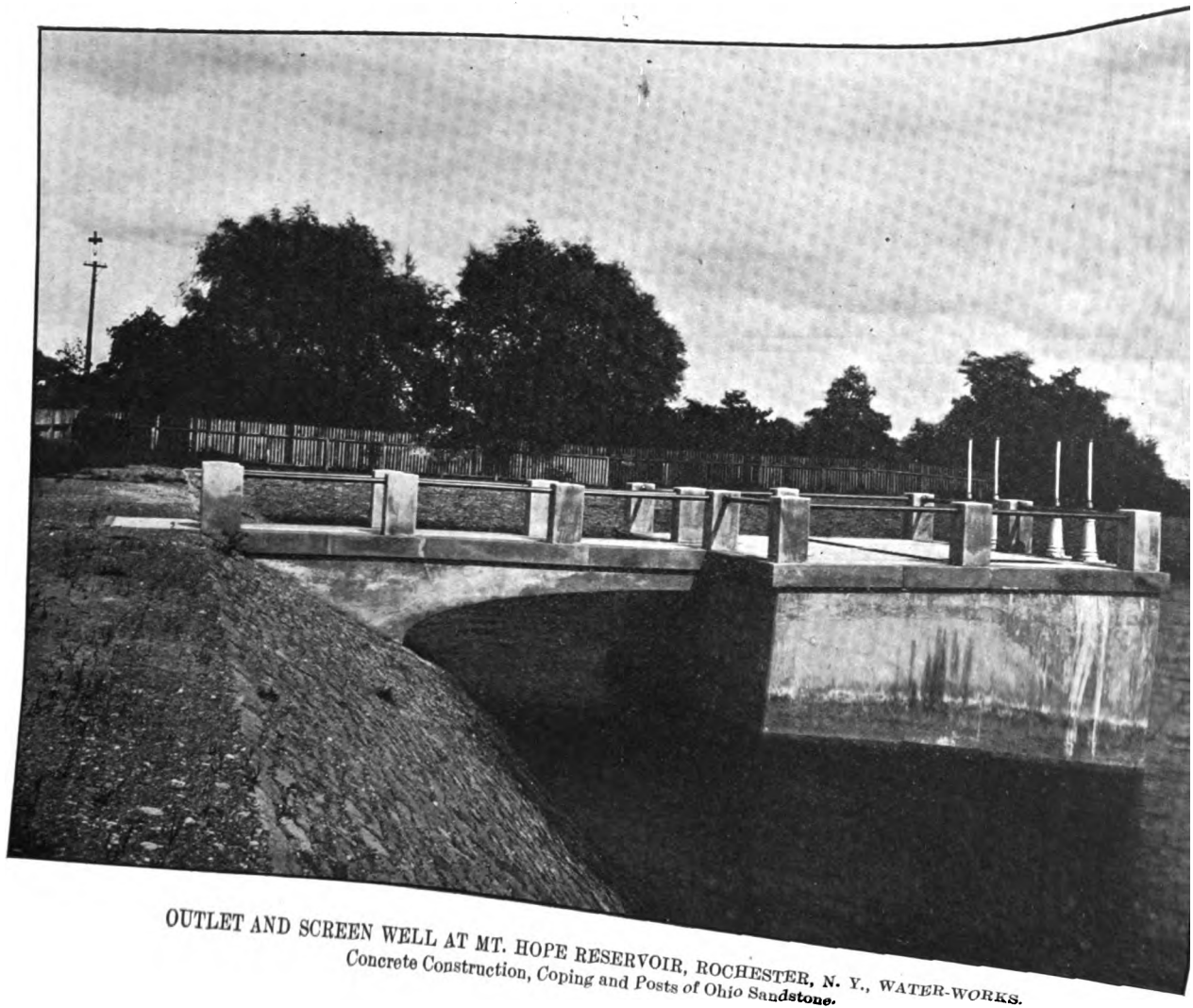

OUTLET AND SCREEN WELL AT MT. HOPE RESERVOIR, ROCHESTER, N. Y., WATER-WORKS.
Concrete Construction, Coping and Posts of Ohio Sandstone.

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Fire Tests with Floors. Particulars of tests with floors of karri wood. Publications of the British Fire Prevention Committee, No. 79. London, 1 Waterloo Place, Pall Mall.

This 16-page book gives the details of a test of karri wood in a floor subjected to a fire of two hours' duration, with temperature gradually increasing to 1,800 degrees F. The fire was under the floor, which was supported on 10 by 10 inch beams of the same timber. The photographs show the fire resisting qualities of the wood and the diagrams and tables give full data of the test.

Papers, Discussions and Proceedings at the Sixth Annual Convention of the League of Michigan Municipalities, held jointly with the Michigan Political Science Association, at Ann Arbor, Feb. 11 and 12, 1904. John A. Fairlee, Secretary, Ann Arbor.

This volume contains a full report of the convention referred to and the papers presented. Some account of the meeting was given in the March number of Municipal Engineering and those of our readers who wish the full text of the papers can probably secure copies of the volume from the Secretary of the League.

Civic Pride. William E. Clark, Editor, 116 Nassau-st., New York City. $1 a year.

This is the latest periodical devoted to the general subject of civic advance and promises to be an appropriate medium for the extension of the knowledge of the work of such societies as the American League for Civic Improvement, the American Park and Outdoor Art Association, the National Municipal League and the American Institute of Social Service, and for the expression of ideas of individuals upon these and related subjects. The page is small, 5 by 8 inches, the paper good and the illustrations excellent.

Chart Method of Reducing Polaris Observations. By Clark Brown, Assistant Engineer, New York State Canals. Paper $1. Cloth $1.50. Published by the author, Albany, N. Y.

This chart with the method on which it is based is intended to supersede the older methods of finding the meridian with the ordinary engineer's transit. It is not sufficiently accurate to be valuable for reducing observations made with geodetic or astronomical instruments. Ob-

The author recommends using the north point as the zero of azimuth, since it is now determined by observations of the stars, especially Polaris, rather than the sun, which was formerly used in the standard methods.

The chart is accompanied by directions for making it applicable to any latitude or longitude and for making the necessary observations with the transit. Times of culmination of Polaris occurring between 3 p. m. and 3 a. m. are given for every day in the year 1901 to the nearest minute. Diagram for correction for any year up to 1921 is given, also diagrams showing difference between standard and local time for any longitude and correction diagram for the period from the time of observation to the time of the nearest culmination.

The instructions are clear and simple and the method is convenient of application and should be satisfactory within the stated limits of its accuracy, i. e., the probable error of an azimuth determined by this method is less than the probable error in the measurement of an angle with an engineer's transit.

The Engineering Press Monthly Index-Review. $2.50 a year. 20 Rue de la Chancellerie, Brussels, Belgium.

This is the new name beginning with April, the first of the second volume, of the Index of the Technical Press. The size of the page is nearly doubled, the abstracts of articles are improved in the way of facilitating reference and the names of articles are arranged under ten principal heads, mechanical, steam, electrical, mining, civil, railway and tramway, shipbuilding and naval engineering, chemical industries, metallurgy, statistics and industrial economy. The new feature is reviews of the principal engineering question of the month and more extended illustrated summaries of the most remarkable papers and articles.

Irrigation Engineering. By Herbert M. Wilson, C. E. Fourth Edition, revised and enlarged. 596 pp., 141 plates, 142 figures. Cloth, $4. John Wiley & Sons, New York City.

This new edition of Mr. Wilson's standard work is called for because of the large amount of work in designing and constructing irrigation works made necessary by the liberal provision of funds

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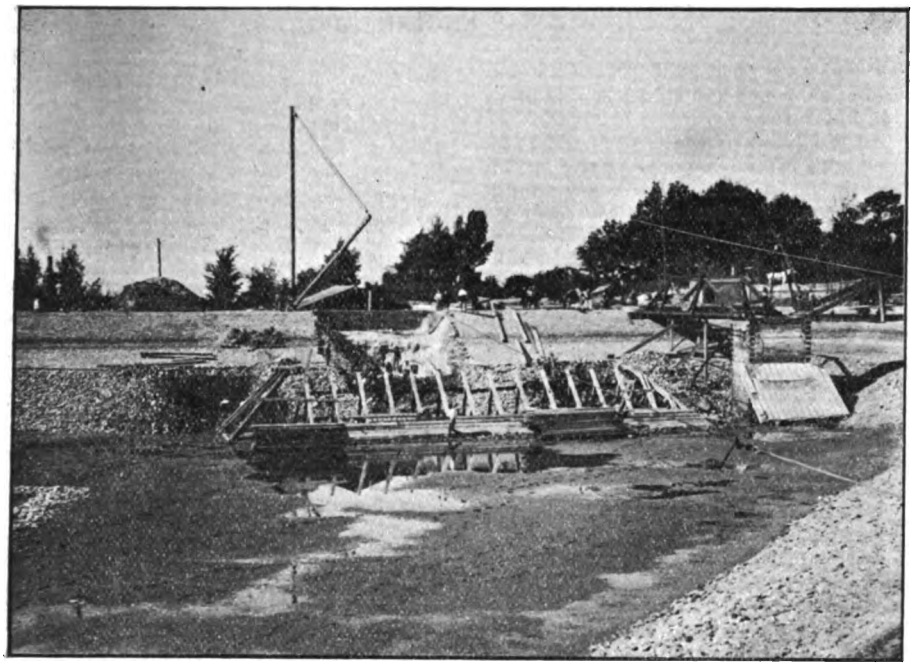
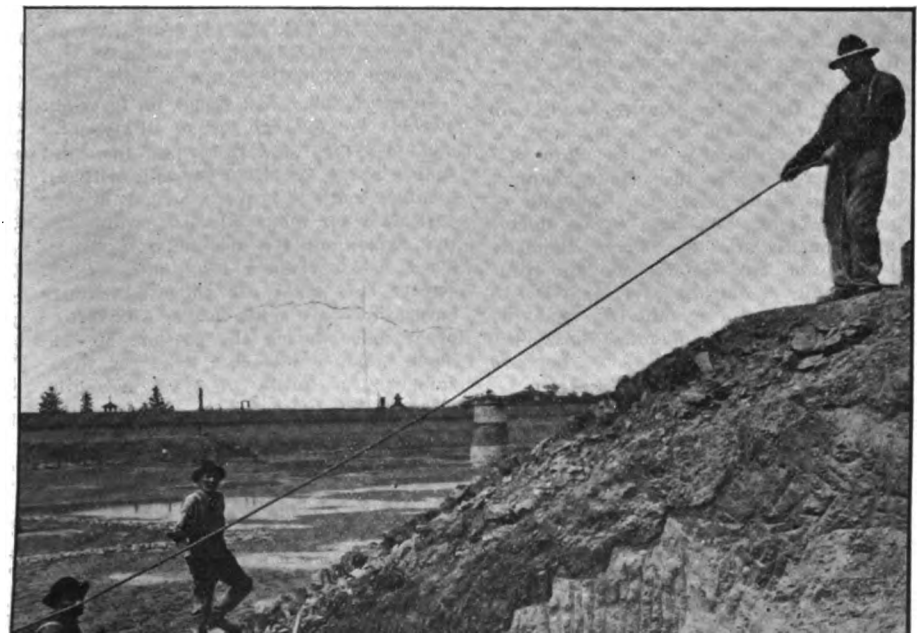


MT. HOPE RESERVOIR, ROCHESTER, N. Y., WATER-WORKS.
Cut in Bank for New Outlet Pipes, Coffer-Dam Partially Constructed.



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by the U. S. Geological Survey on precipitation, runoff and stream flow is given its proper place.

All the questions which arise in connection with irrigation works receive as full treatment as their relative importance and the space available permit. They include in addition to those named above, evaporation, absorption, seepage, alkali, drainage, sedimentation, quantity of water required, flow and measurement of water in open channels, subsurface water and sewage for irrigation, which are treated in the first part.

The second part takes up the subject of canals and canal works, including alignment, slope, cross-section, headworks, diversion weirs, scouring sluices, regulators, escapes, falls, drainage works, distributaries, application of water and pipe irrigation.

The third part, devoted to storage reservoirs, has considerable new material on account of the new works described and the new investigations which have been made. It treats of the location and capacity of reservoirs, earth, loose rock and masonry dams, waterways, outlet sluices, pumping, tools and maintenance.

While it cannot be said that the treatment of many of the subjects is exhaustive, the book is a valuable text-book and gives a most excellent view of the problems which arise in irrigation work and guidance for more detailed study. An excellent feature is the bibliography of the subject, which is divided into sections corresponding to various chapters in the book and inserted at the ends of those chapters. The index covers thirty-three pages and is fairly complete, though not cross-referenced, and thus occasionally requiring several trials to find the entry for a subject. Thus the lists of books must be found under the heading, "Reference Works." They are also given under "Works of Reference," when a cross-reference would have saved several lines and made room for cross-entries under "Books," etc. A glance through the indexing of the Ganges irrigation works indicates a lack of system, while it shows that everything of im-

hind time. The appendix on the electric condition of the water pipe system, son extracts from which will be found els where in this number of Municipal En gineering, bears the date of Oct. 1, 1903.

The ash collection of the city relieve the householder of all trouble. Mixtu with the ashes of paper and oth materials greatly increases the cost removal, which is paid for at $1 a loa without reference to weight. A charge f rubbish of 10 cents a barrel, with free r moval of all clear ashes is proposed, b has given rise to much opposition.

Street repairs have cost $26,036, of whic asphalt streets have taken $20,134. The were 426,073 square yards of pavement which repairs were made, making t average cost 4.72 cents a square yard f the year. This is the heaviest cost r ported, the next being in 1897, the fir year in which general repairs were mad when the cost was 4.21 cents. There we about 25,000 square yards of pavement which guarantees had expired on whic repairs were not made. Deducting t area kept in repair by the street railwa company, there remain 432,598 squa yards of pavement to be kept in repair b the city. The average cost per squa yard on this area was 4.53 cents. A vie of the Colvin-st. asphalt pavement wi be found on another page.

Street cleaning cost $95,160, on forty-s streets. The average cost of all sweepin and cleaning was $28.30 per thousan square yards, or $462.69 per mile with a average width of 28 feet. Asphalt street cost $35.28 per thousand square yards f the season, or $576 per mile of stree They were cleaned 128 times. Bric streets cost $23.85 per thousand squa yards, or $472 per mile, cleaned an averag of 53 times during the season. Medin block stone streets cost $58.69 per thou sand square yards, or $1,678 per mil cleaned 120 times. The Medina ston streets are wider than others. If 27 fee wide they would cost $929 a mil Macadam streets cost $16 a thousan square yards, or $318.70 a mile, 12 time cleaning during the season.

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and the water works were fully described in papers which appeared in Municipal Engineering in November, 1902. Elsewhere in this number will be found photographs of the Rush storage reservoir and of the work on the new outlet pipes and screen well for the Mt. Hope reservoir. One of the smaller views shows the cut in the bank for the new outlet pipes with the coffer dam under construction. The other small cut shows the detail of the bank and the character of the puddle lining disclosed by the cut. The reservoir is on a sand hill and the puddle lining is stepped into the original sand in the manner shown.

Another view shows the half-arch concrete bridge from the reservoir bank to the top of the screen well.

Six inches of gravel was originally put on the clay puddle lining. When the reservoir was emptied for the construction mentioned many crawfish were found and under each stone large enough to hide a crawfish was found a hole. Many of these holes went through the lining, permitting the water to leak into the sand beneath. This leads to the recommendation that all stones over an inch in diameter be excluded from the gravel lining or that it be replaced by continuous concrete, asphalt or brick.

We are indebted to City Engineer Fisher for the use of the illustrations.

Public Work in Chicago.

By C. B. Maugham.

The municipal government of Chicago has willingly surrendered into the hands of private citizens the task of cleaning the streets of the central business district of the city. Roused by the continued failure of the proper authority to keep the streets free of rubbish, and realizing that the time-worn plea of "no money" would be interposed as an excuse for further inaction, two of the most influential business men's clubs decided to promote a movement to raise funds by personal contributions of citizens to engage the labor necessary to clean the streets in question under the supervision of committees of the organizations. The Commercial and Merchants' Clubs readily obtained the consent of the mayor and council to carry out the task. The city surrenders to the clubs' committees the sum of $24,000 on hand appropriated for cleaning the streets in the territory covered by the business men's project. The clubs will raise $36,000. The clubs will act as contractor for the city, securing a contract from the city council, after being duly incorporated, to make the action legal.

The long tie-up of the building operations in Chicago due to the lockout of the lime, stone, cement and concrete teamsters has been ended at last and thousands of carpenters, bricklayers, stonemasons and other building mechanics who were idle for many weeks have resumed work. The loss to both workmen and employers has been vast, and owners and investors in new buildings have also suffered heavily.

The trouble was adjusted by the building material men and manufacturers yielding and making concessions to the teamsters. Under the agreement made the men are receiving now straight eleven-hour a day work and an advance of 60 cents a week, the schedule being as follows: Single horse, $12.30; double, $14.10; three-horse wagon, $17.10. Overtime is figured before 6 o'clock a. m. and after 6 o'clock p. m. Nearly 25,000 men were affected by the lockout.

Despite the settlement the building industry in Chicago is crippled by the high price of brick. In Chicago the price is from $7.50 to $8 a thousand, while in nearby towns it is selling from $5.50 to $6. Small contractors prefer to be idle rather than pay the high prices asked. There is no check in building on a large scale in the downtown business district, as the big contractors are apparently able to pay the high cost of the brick.

Prices of other materials are satisfactory for the most part to dealers and promise to be considerably higher than was the case last year.

Demands for cement are most encouraging, but dealers and manufacturers for the most part are not looking for such high prices as prevailed last year and are apparently contenting themselves with the prospect that the price will remain in the neighborhood of $1.50.

Under a ruling made by the corporation counsel of Chicago the claim of the Robert W. Hunt Company against the city for a share of the bonus given the Henry R. Worthington Company for excellence of the pumping engines furnished the city in 1897, is invalid. The corporation counsel suggests a hearing before a judge. The Hunt Company demands $900 for inspecting the engines.

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ORGANIZATIONS AND INDIVIDUALS

American Park and Improvement Society—National Municipal League—Technical Meetings—Personal Notes.

The American Park and Improvement Society.

The American Park and Outdoor Art Association and the American League for Civic Improvement propose to combine their efforts under the name of the American Park and Improvement Society. They will hold a joint meeting in the Minneapolis and St. Paul building at the St. Louis exposition, June 9-11, 1904, at which it is expected that the consolidation will be effected. A good program of addresses and reports of special committees is promised. Among those announced are papers on school gardens, municipal art, park census, village improvement, public advertising, railroad improvement, local improvement, libraries and museums, forest reservations, and arts and crafts. Addresses will also be made by Prof. Charles Zueblin, Clinton Rogers Woodruff, Mrs. Charles F. Millspaugh, George Carroll Curtis and others. The meeting is in the week preceding "Civic Week" at the exposition. Earle Layman, 605 Colonial Trust building, St. Louis, is the chairman of the local committee of arrangements.

Convention of the National Municipal League.

As noted in the May number of Municipal Engineering, the convention of the National Municipal League, which was in session as it went to press, had an exceptionally good program. A few extracts from the papers presented are here given to show the quality of the work done and the value of connection with the society.

The League was the guest of the City Club of Chicago which recently was or-

city of Chicago by non-partisan and practical methods.

Prof. F. H. H. Roberts of the University of Denver gave an interesting history of the development of home rule in Denver.

After one or two attempts upon the Legislature, in 1902 the Rush amendment to the State constitution, which guaranteed home rule to Denver, with the restriction that every charter should provide for initiative and referendum, limited civil service and the granting of franchises only on the approval of the people was submitted to the people and ratified by them Nov. 4, 1902. The amendment was, by the Governor, declared to be in force Dec. 1. At once a case, entitled State vs. Sours, was taken into the Supreme Court attacking the constitutionality of the amendment. The majority of the court sustained its constitutionality in a decision handed down Feb. 27, 1903. The first charter convention was held and a charter providing for the initiative and referendum, recall, municipal ownership and civil service, thus carrying out the full intent of the Rush amendment, as adopted and submitted to the people. The charter was rejected by them Sept. 22, 1903.

The second convention avoided what was, in certain quarters, considered the dangerous requirements of the Rush amendment. Twenty-five per centum of the qualified electors must sign a petition before the initiative and referendum can be exercised. While the amendment provides that franchises must be granted after a vote of the qualifying taxpaying electors, the charter allows the granting of revocable 'licenses and permits' to occupy alleys, streets, etc. Civil service was reduced to a minimum. At an election held March 29, 1904, this charter was ratified by a vote of two to one. This vote shows a change of opinion in Denver upon questions of municipal reform, yet this does not account for the large majority in favor of the charter. The

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and the majority hold it is subordinate in matters that usually belong to the county, since Denver is a county as well as a city.

Dr. Ellis P. Oberholtzer gave a history of the establishment of home rule for cities in the States of Missouri (1875), California (1879-1890), Washington (1889), Minnesota (1896), Oregon (1901), and Colorado (1902). He sums up in the following paragraph:

To recapitulate, the situation in these six States is as follows: In all but one of the States charters are framed by a body called a board of freeholders; in the other, Colorado, it is called a charter convention. Whatever the name it is in each instance a committee of citizens of the municipal district to which the new scheme of government will apply. This board is composed of fifteen members except in Missouri, where thirteen suffice, and in Colorado, where twenty-one are considered to be necessary. In all the States but Missouri the body is elected by the people of the city for the single and specific object of drawing up a charter. The privilege is restricted to cities containing a stated number of inhabitants, except in Minnesota and Oregon, where all cities may enjoy it equally. In California the lowest limit is a population of 3,500 (earlier 10,000 and still earlier 100,000); in Washington, 20,000; in Missouri, 100,000, and in Colorado, 2,000. In all six States the charters being framed are to be submitted to the people for their approval, a simple majority vote sufficing in St. Louis and in California, Washington, Colorado and Oregon. A four-sevenths majority is necessary in Kansas City and in Minnesota. In one State, California, the charter, after it has been adopted by the people, must be referred to the State Legislature, although only for its "approval or rejection as a whole" and without power of alteration or amendment in details.

Dr. Oberholzer is not certain that home rule is the best solution of the problems of municipal control, as will be seen from his closing words:

Where the effort has been made to constitute the city "an empire within an empire," with not too careful regard for its continued obligations to the State, the Legislature is as active in its interferences as it ever was. The courts have repeatedly declared that a city, although organized under a charter of its own framing, must still submit to State control. While some difficulties are put in the way of special legislation for cities it is not made wholly impossible. The reference of the bill to the locality to be affected by it affords an opportunity for public discussion, and should it really be an unworthy measure it is reasonable to think—at least this is the underlying theory—that it could not be so easily passed a second time in the face of local disapproval.

At the moment the balance is on the side of the freeholders' charter, but the system, up to this time, has secured a foothold only in the West, where institutions are sometimes fleeting and tendencies temporary. In the East where less faith in democracy is expressed and radical measures are not so favorably regarded the suggestion that the city be pitted against the State in unhappy combat is not enthusiastically received. To the student of constitutional law home rule through city-made charters appears to be only one of several not too well considered forms of protest against municipal rascality. Until the cities which frame their own charters can demonstrate that their success in government is in some important way greater than our success in New York, Boston, Philadelphia and Chicago, the rest of the country will be skeptical of the worth of the system. When all the arguments have ended and the discussion of forms, theories and methods has run its course the fact remains that that city will be the best governed which is in the hands of the most capable body of administration.

The discusion of the question of municipal ownership by Prof. James Mavor of the University of Toronto led him to the following conclusion:

The total effect of the municipal monopolies is not disclosed by the municipal accounts, even when these are kept in the most perfect manner. The effect of the gas monopoly in retarding the adoption of electric lighting both for public and for private purposes, and the effect of the quasi-monopoly of urban transportation in arresting the development of cities, cannot readily be reduced to statistics, yet they are nevertheless of national importance. Private enterprise, criticised and inspected by the public authority, and compelled by it to live up to its obligations, appears to be of greater benefit to society as a whole than a bureaucratic system in which the citizens are compelled to become contributors to enterprises in which they hold no real share, no share, that is, which is transferable. The 'corporation' is as much a servant of the public as is the City Council, and for certain purposes it is preferable as a servant, because the limits of its obligations and its cost can be more exactly defined.

The Good Roads Convention at St. Louis.

The International Good Roads Convention held at St. Louis May 16 to 21 was largely attended. A daily session was held three hours in length, leaving plenty of time for the exposition.

Pres. W. H. H. Moore showed in his address the loss of $2,700,000 in Missouri

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alone by work on roads, the effects of which disappeared almost as soon as the work was done. He presented a bill providing for a State engineer and for State aid in road building, based on the Arkansas law.

The United States government officials, including Martin Dodge, Director of the Office of Public Road Inquiries; James Wilson, Secretary of Agriculture, and J. B. Lloyd, a Representative from Missouri, advocated government aid for road building, and the expansion of the office of Public Road Inquiries that it may be able to give still more thorough and widely spread instruction upon road building in the various sections of the country.

Mr. A. W. Campbell, highway commissioner and engineer of Ontario, gave a practical talk on the improvement of earth roads, laying stress on the value of organization and proper supervision by expert road engineers.

The wheelmen and automobilists had their opportunity to emphasize the same points. Senator Latimer presented the advantages of the national aid bill, which proposes an appropriation of $8,000,000 a year for three years.

The "model street" was on exhibition in the model city on the exposition grounds, including two samples of standard stone road construction in New Jersey.

Technical Meetings.

The next congress of associations for testing materials will be held at St. Petersburg, Russia, in August. The effect of sea water on cement construction will be discussed, several engineers and experts taking a position averse to the use of Portland cement for sea walls or for any work exposed to sea water. In behalf of the cement manufacturers a report in opposition to the view of the engineers and experts will be presented, and it is expected that the report will demonstrate beyond doubt that cement construction does not suffer from sea water exposure

The annual meeting of the American Waterworks Association will be held at St. Louis, Mo., June 6 to 10. J. M. Diven, secretary, Elmira, N. Y.

The eighth annual convention of the

A joint meeting of the American Park and Outdoor Art Association and the American League for Civic Improvemen will be held at St. Louis June 9 to 11 Charles Mulford Robinson, secretary Rochester, N. Y.

The annual convention of the Canadian Electrical Association will be held a Hamilton, Ont., June 15 to 17. C. H. Mortimer, secretary, Toronto, Ont.

The annual meeting of the American Society for Testing Materials will be held at Atlantic City, N. J., June 16 to 18 Prof. E. Marburg, University of Pennsylvania, secretary, Philadelphia.

The International Engineering Congress will be held at St. Louis October 3 to 8 under the auspices of the American Society of Civil Engineers Charles Warren Hunt, secretary, 220 W. Fifty-seventh-st. New York City.

The joint meeting of the American Society of Mechanical Engineers and the Institution of Mechanical Engineers of Great Britain is held in Chicago, May 8 to June 3. One session is devoted largely to the discussion of methods of destruction of town refuse.

The seventh annual meeting of the American Society for Testing Materials will be held at Atlantic City, N. J., June 16, 17, 18. An elaborate program is in preparation.

The Municipal Engineers of the City of New York now have headquarters at Cambridge Court, 142 W. Forty-ninth-st Manhattan, which are open from 8 a. m to midnight every day. The meeting of May 25 was held at the Chemists' Club and Mr. Martin Gay presented a paper on the bridges over the Harlem River which was illustrated with stereopticon views.

The National Electric Light Association met in Boston May 24 to 27. Among the papers presented were the following:

"The Sale of Electrical Energy," by W F. White.

"A Hundred-Mile Transmission Line," by Robert Howes.

"The Mechanical Stoker and the Human Operator," by Edwin Yawger.

"Single-Phase Power Motors for Electric Lighting Stations," by W. A. Layman.

"A Three-Wire, 500-Volt Lighting System," by Walter I. Barnes.

"Notes on the Internal-Combustion En-

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There was also a valuable paper on "Underground Construction."

U. S. Civil Service Examinations.

Examinations will be held by the United States Civil Service Commission at the usual places on June 8 for civil engineer in the Bureau of Forestry, Philippine service, at $2,400 a year.

Examinations will be held June 15 in steam engineering, electrical engineering, heating, refrigeration, gas and gasoline engnes and hydraulics to fill vacancies in the Indian service at salaries of $480 to $1,000 a year.

Personal Notes.

F. L. Dormant has been appointed city engineer at Houston, Tex.

H. G. Paddock has been reappointed city engineer at Moline, Ill.

H. A. Collar has been reappointed city engineer at Lansing, Mich.

F. C. Tucker has been appointed city engineer at Deadwood, S. D.

George F. Ashton has been appointed city engineer at Lynn, Mass.

George F. Ashton has been appointed city engineer at Salem, Mass.

J. Walter Ackerman has been appointed city engineer at Auburn, N. Y.

J. Ross Robertson has been reappointed city engineer at Keokuk, Ia.

James P. Morrissey has been re-elected city engineer at Dunkirk, N. Y.

F. B. Carson has been appointed city engineer at New Kensington, Pa.

Robert Dougherty has been re-elected engineer at Middlesex County, N. J.

William R. Caldwell has been appointed city engineer at Traverse City, Mich.

Hon. J. W. Deering, ex-Mayor of Portland, Me., died April 26, aged seventy years.

T. L. Smith, Jr., Jun. M. Am. Soc. C. E., has been appointed city engineer at Eagle Lake, Tex.

William Steyh has been elected city engineer, succeeding Emmet A. Steece, at Burlington, Ia.

George G. Townsend, Frostburg, Md., has been appointed road engineer of Allegany County.

Frederick E. Williams has been appointed fire chief, to succeed Morris F. Gardner at Montclair, N. J.

Ernest W. Krueger has resigned his position of superintendent of water department at Rock Island, Ill.

Albert H. Fletcher has been appointed superintendent of the Framingham Water Company, at South Framingham, Mass.

John Findley Wallace of Chicago has been appointed chief engineer in charge of construction of the Panama Canal.

Albert Bryton Storms, A. M., D. D., will be installed as president of Iowa State College of Agriculture and Mechanic Arts, on June 6.

Francis J. McNulty, president of the City Council at Wilmington, Del., was elected assistant chief engineer of the water department recently.

Leonard Curshaw, city engineer of Denver, Colo., from 1878 to 1880, and former deputy U. S. Surveyor, died at his home in that city April 22.

Conrad F. Stollmeyer, known as the "Pitch Lake King," and the wealthiest man in the Caribbeans, died at the Port of Spain, Trinidad, recently, aged ninety-one years.

Lewis M. Hastings has been appointed city engineer at Cambridge, Mass., to succeed James W. Pierce. Mr. Pierce succeeded Mr. Hastings in the same position about a year ago.

Richard L. Humphrey has been appointed by the Association of Portland Cement Manufacturers to take charge of the testing laboratory in the cement exhibition building at the Louisiana Purchase Exposition.

The Frederic Brown Company, New Orleans, La., has been organized by Frederic Brown to engage in all kinds of engineering works. Offices have been opened in the Hibernian Bank Building, New Orleans, and branches will be established in Mexico and the West Indies.

The proposed amendment to the appropriation bill for the District of Columbia prohibiting the inspector of asphalts and cements from doing outside work was changed so that he can do the work, but without charge. It is probable that the present incumbent, Mr. A. W. Dow, cannot be long retained at the small salary attaching to the office, and his departure to a more lucrative field will be a distinct loss to the engineering department of the District of Columbia.

Linch & Sproehnle is the name of the new firm of consulting and contracting engineers at 916 Pennsylvania Building, Philadelphia, Pa. Mr. Linch has been at the same location for some time and Mr. Sproehnle is a new partner in the business. The firm is now fully equipped for handling any proposition which may arise in power equipment, railroad work, cement plants, graphite plants. The firm has now on hand electrical and hydraulic work in the installation of power plants and electrical railways and also a large sewage disposal plant.

MUNICIPAL OFFICIALS ELECTED.

Mayors and city officers have been elected during May as ollows:

—Indiana—

Terre Haute—Edwin E. Bidaman, mayor; Frank Buckingham, city comptroller, re-elected.

Crawfordsville—Ed Voris, mayor; Jesse Canine, city treasurer.

Shelbyville—John W. Vannoy, mayor; Geo. M. Robins, city treasurer, re-elected; Edward C. Newton, city clerk.

Hammond—Lawrence Becker, mayor.

Columbus—P. H. McCormick, mayor; Geo. Worwald, city clerk.

Warsaw—A. C. Wood, mayor

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South Bend—Edward J. Fogarty, mayor, re-elected.

Anderson—John L. Forkner, mayor, re-elected; Dr. A. W. Miller, Dr. J. A. Walser and William Lumey, councilmen; Frank Sharp, city clerk.

Seymour—George G. Graessle, mayor; Fred Everbach, city clerk; Thos. J. Clark, treasurer.

East Chicago—Mayor Hale re-elected; J. J. Keenan, city clerk.

Noblesville—John Dulin, mayor.

Lebanon—John M. Hoy, mayor.

Brazil—Roy Shattuck, mayor; A. S. Decker, treasurer; Fred De Army, city clerk.

Alexandria—James H. Edwards, mayor; Horace Inlan, city clerk; James S. Wales, treasurer.

Bluffton—John Mock, mayor.

Muncie—Charles Sherritt, mayor.

Michigan City—John E. Schultz, mayor.

Valparaiso—William Spooner.

North Vernon—Harry C. Moloy, mayor; Ralph W. Norris, city clerk; Edward W. Tech, treasurer.

Hartford City—James Lucas, mayor.

Rising Sun—Mayor Matson, re-elected.

Aurora — Louis Brernkamp, mayor; Charles Webber, city clerk.

Greenfield—G. A. Carr, mayor, re-elected.

Delphi—George Ives, mayor; John W. Fawcett, city clerk; James W. Ramey, treasurer.

Winchester— .... Focht, mayor.

Richmond—W. W. Zimmerman, re-elected.

Frankfort—D. W. Paul, mayor.

Kokomo—Mayor Brouse, re-elected.

Rushville—Frank J. Hall, mayor; Harry Lakin, city clerk; H. V. Stivey, treasurer.

Huntington—J. Fred France, mayor.

Connersville—Mayor Gray; J. S. Clouds, city clerk, re-elected.

Linton—John W. Wolford, mayor.

Jeffersonville—Henry A. Burtt, mayor.

Greencastle—James McD. Hayes, mayor; George Black, city clerk; Walter Allen, treasurer.

Lafayette—George R. Durgan, mayor; Edward H. Andress, city clerk.

Franklin—Dr. J. N. Nixon, mayor, re-elected; Arthur Owens, city clerk, and Victor Bergan, treasurer, re-elected.

Wabash—Mayor Murphy; city clerk, McLees, and treasurer, Brown.

Logansport — George McKee, mayor; Fred Hermontree, city clerk; Fred Goerger, treasurer.

Lawrenceburg—E. M. Lee, mayor.

Vincennes—G. E. Green, mayor; Thomas Robertson, city clerk; Thomas Esthen, treasurer.

Goshen—Alfred Lowrey, mayor

Laporte—Lemuel Darrow, mayor; C. E. Wolfe, city clerk; A. G. Freese, treasurer.

Marion—Field W. Swezey, mayor

Loogootee—Will K. Penrod, mayor; J. B. Love, treasurer.

Union City—C. S. Hardy, mayor; John Butcher, treasurer; C. I. Williamson, city clerk.

Washington—Hale Clerk, mayor.

Rensselaer—James H. Ellis, mayor; James H. Chapman, treasurer; Charles Morlan, city clerk.

Tipton—Seneca Young, mayor, re-elected.

New Albany—William V. Gorse, mayor; Jacob Bost, treasurer; Eugene Brisby, city clerk.

Martinsville—Harvey Baker, mayor; Charles Marley, city clerk; Frank R. Babb, treasurer.

Bloomington—Claude Malotte, mayor; William F. Browning, city clerk; Harry A. Axtell, treasurer.

Elwood—C. W. Smith mayor, re-elected; W. A. Lewis, treasurer; Manford Maines, city clerk.

Portland—C. H. Ayers, mayor; Horace Antrim, city clerk; Frank Smith, treasurer.

Huntington—J. Fred France, mayor; Joseph Carrol, city clerk, and R. S. Martin, treas., re-elected.

Peru—William Odun, mayor.

Princeton—A. P. Twineham, mayor.

Auburn—James McClellan, mayor; Ed Little, city clerk; Geo. Schab, treas.

Veedersburg—A. M. Boce, mayor; I. J. Walker, city clerk; D. H. Wallace, treas.

Covington—Oliver S. Jones, mayor; N. G. Harlew, treas.; Thos. McGeorge, city clerk.

Dunkirk—John Aines, mayor.

Montpelier—Eli Bryson, mayor.

Garrett—Mayor Thuman, re-elected.

Elkhart—Mayor Green, Treasurer Campbell and City Clerk Anderson, re-elected.

Columbia City—Jas. R. Harrison, mayor; Frank Hall, city clerk; Wm. Feaster, treas.

Tell City—Theodore Kiefer, mayor; Frank Hinkel, city clerk; J. Keller, treas

Mishawaka—Melville W. Mix, mayor, re-elected.

—Maryland—

Glen Echo—John A. Garrett, mayor; councilmen, Wm. H. Roach, Jacob J. Decker, Guy E. Jenkins, Thomas A. Weaver and Chas. W. Geddes.

Takoma Park—John B. Kinnear, mayor; councilmen, Lisle Morrison, E. M. Douglas, J. H. Van Houten, J. B. Derrick, C. W. Scudder and E. H. Blodgett.

Hyattsville—Mayor Wells, Town Treasurer Richardson and Councilman Chas. H. Long, re-elected.

Bladensburg—Fred Heller, re-elected, and Marion Duckett. Francis Gasch, John Lepper, G. A. Dahler and John Rohrbach, newly-elected members of the Town Board of Commissioners.

Rockville — Hattersly W. Talbott, re-elected Mayor; Councilmen, Willis B. Burdette, Lee Offutt, Robert C. Warfield and David J. Bready.

Kensington — Cornelius Eckhardt, re-elected Mayor; Councilmen, A. W. Cromwell and C. W. Hurdle.

—New Jersey—

Morristown—Charlton A. Reed, re-elected Mayor; Aldermen, Frank E. Lippman, James F. Belby, Oliver K. Day, Walter T. Lewis.

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MACHINERY AND TRADE

A Manageable Hose Nozzle.

Anyone who has ever witnessed the operation of fighting a fire must have been impressed with the awful force of the water as it issues from the nozzle of the hose. The services of three or four firemen are often required to hold and direct the stream, and it is a frequent occurrence, at that, for the nozzle to break away from their grasp, and under the influence of the mighty force of water being driven through its interior, be hurled right and left, like a mighty serpent on a rampage, seriously injuring anyone who might be unfortunate enough to get within its reach. The only way which the rearing and tearing monster can again be secured is by stopping the pump, and much time is lost before this can be done. A new nozzle which can be handled as easily as a child is just now being brought to the attention of the fire departments of the country. Its remarkable behavior under the highest pressures is attracting the wonder of the men who thought the old nozzle, which has been in use so long with all its faults, was about as near perfect as it was possible to make it. A trial of the device was made recently in New York, when one of the nozzles was connected with three streams, each 2½ inches in diameter, with a pressure at the pumps of 160 pounds. The machine was bolted to a plank, and the latter was nailed down with seven tenpenny nails, and this was entirely sufficient to hold the nozzle under all circumstances.

One man could easily direct the stream to any desired point, and after it had been placed as desired, the nozzle remained unsupported without the least variance under the pressure of the water. The upper part of the device consists of a nozzle much the same as is in use at present except that it is finished at the base with a ball joint. The ball end is supported by a stand, which divides at the top to receive and support the end of the nozzle proper, and the stream being divided enters the tube of the nozzle from both sides, which comprises the essential feature of the device. One would naturally conclude that the efficiency of the stream would be impaired by its passage through the two channels, but at the lower pressures there was no change whatever as compared with the ordinary nozzle, while at the higher pressures the difference was very slight. There are several types of the apparatus, and the one tried in New York was the one designed for the heaviest work. Those which are made for handling a single stream of ordinary dimensions are supplied with a stand, which is meant to be merely placed on the ground without any fastenings whatever. When it has been thus located, it needs no further attention, except when it is desired to make a change in the direction of the stream occasionally. The Glazier Nozzle and Manufacturing Company of Indianapolis, Ind., makes this valuable piece of fire apparatus.

The Seamans Brick Machine.

Mr. E. W. Seamans of Grand Rapids, Mich., who has long been favorably known in the invention and manufacture of cement block machines and cement curb, has recently devised a new machine for making cement brick upon the same lines as his latest hollow block machines. The machine is in fact a series of ten molds formed in a long box by means of partitions, which are attached to a plate and are readily withdrawn when desired. It is operated in the same way as the block machine, which has been described in Municipal Engineering.

In setting up the machine the plate holding the vertical steel plates forming the division walls of the molds is set on a convenient solid support, or, if necessary, on the ground. The frame of the machine, having slits to fit the partitions, is next put on, slipping down over the partitions, and thus forming the mold surfaces for the bottom and sides of the brick. Two steel sides are then put in place to form the ends of the molds. These side plates are set in ingeniously adjustable holding grooves, so that no

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expert attention is required to set the machine up.

When thus put together the molds are filled with the mixture of cement and sand or gravel, which is comparatively dry, and it is tamped as thoroughly and carefully as desired, and the top is smoothed off. A heavy plank a few inches longer than the machine is then put on top of the machine and the whole is turned bottom up. The plate with the partitions is withdrawn, the stripper plate forcing it to come up vertically without sideways motion to disturb the bricks, and it is set in position for another lot of brick. The machine frame is then lifted and put in its place and lastly the sides are taken off. The machine is then ready for another set of brick and the set already made is removed on the plank and stacked for curing in a series of shelves, blocks on the ends of the planks keeping them the proper distance apart vertically, so that the blocks can be sprinkled during the process of curing.

It is said that, with the materials mixed at hand, two men can turn out ten brick per minute. Any desired molding, beading, or forms or fractions of bricks can be made by inserting blocks of the proper forms in the molds. The standard forms are shown in a photograph which appears in Mr. Seaman's advertisement on another page of this number of Municipal Engineering.

Bricks of any desired size can be made by ordering a machine with the proper dimensions. The entire machine is of steel and is heavy enough to supply all the rigidity required, but at the same time it is light enough to be easily handled by two men.

The inventor recommends a mixture of 600 pounds of cement to 40 cubic feet of sand and fine gravel for common brick; 800 pounds of cement to 40 cubic feet of torpedo sand for fine face brick; and 1,000 pounds of cement to 40 cubic feet of fine sand for pressed brick. The only extra cost for ornamental and fancy brick is in the time necessary to insert the special forms. These could be fastened to the stripper plate in case large numbers of such bricks were required, and this time

Mold Manufacturing Company of Sa City, Ia., is described as follows:

The outside mold is made in two part and the inside mold or core is in thre pieces, both hinged with heavy meta hinges and fastened with free workin metal pins; the inside core opens inward ly and is removed in sections as soo as the tile is made, by simply withdraw ing the pins, which do not bind and ar removed quickly and with ease. An common laborer can set up th forms and make the tile, no skilled labo being required if directions are followed The outside mold must remain intac from twelve to twenty-four hours, ac cording to temperature, therefore twent to forty outside molds can be used t one inside core, which greatly reduce the cost of molds, as a hopper and tam must be furnished with every inside core

Sewer pipe, road culvert tile and wel curbing, as well as drain tile, are al manufactured with the same molds. Th work is best conducted in a building wit a cement floor, but can be successfull carried on in the open air. When til are made in the open air it is necessar to have bottom boards in order to hav a level surface. The tile can be remove from the board when five days old an shipped when thirty days old. However holding them for sixty days is advised as their strength increases with age. Th cement building block of today is one o the important industries of the century The work with these molds is similar an can be carried on at the same time, un der the same roof.

One barrel of cement will make twenty four tile twelve inches in diameter an two feet long, or ten tile eighteen inche in diameter and two feet long, or eigh tile twenty-two inches in diameter an two feet long. One man will make twen ty tile eighteen inches in diameter in on day.

A St. Louis Landmark.

St. Louis has a number of landmark which have become familiar to her citi zents and to the traveling public, and an other one has just been added, which wil enable the traveling public coming into the city either over the Eads Bridge or

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It is as visible at night as during the day, for it is an electric sign and catches the eye immediately. It helps to show the great strides which this company has made since starting in business in 1857. At that time the business was known as Adolph Leschen, and was continued until 1872, when it was changed to A. Leschen & Son, at which time Mr. Henry Leschen, who is now president of the company, became a partner in the business with his father. In 1886 it was changed to A. Leschen & Sons Rope Company, under which name is operates at the present time.

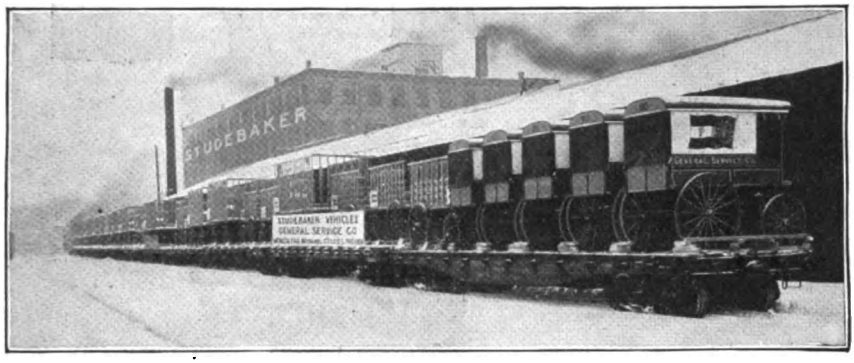
This company has just completed the erection of probably the largest and handsomest wire-rope factory in the country on thirty-one acres of ground, which they purchased something over a year ago, between Hamilton and Hodiamont-aves., in the northwestern part of town.

It was not very long ago that they completed an Aerial Wire Rope Tramway in Wyoming between sixteen and seventeen miles in length on which almost seventy miles of wire rope was used.

In addition to this the Studebaker Company has also furnished complete sets of harness for all styles of horse vehicles that will be used on the grounds.

It should certainly be a matter of no little pride to the Studebaker people that the quality, style and general excellence of their vehicles have resulted in the exposition authorities placing their entire order for vehicles and harness with this well-known firm.

Visitors to the exposition grounds will find the Studebaker very much in evidence on the grounds, but they will also find it worth while to look up the Studebaker exhibit in the Transportation Building, east center. It is understood that this will be the most extensive and complete exhibit of vehicles seen at a world's fair.



STUDEBAKER VEHICLES FOR ST. LOUIS EXPOSITION.

Vehicles at the Exposition.

The accompanying illustration shows a train-load of vehicles shipped to the General Service Company, St. Louis, Mo

A New Automatic Cement Testing Machine.

The Falkenau-Sinclair Machine Company of 113 N. Twenty-second-st., Philadelphia, Pa., is introducing a new automatic cement testing machine, patent for which was recently issued. This machine we illustrate in the accompanying cut, and would briefly describe it as being of the general type known as a "shot" machine. Machines of this type are based on the original Michaelis machine, and bird shot is the medium used for applying

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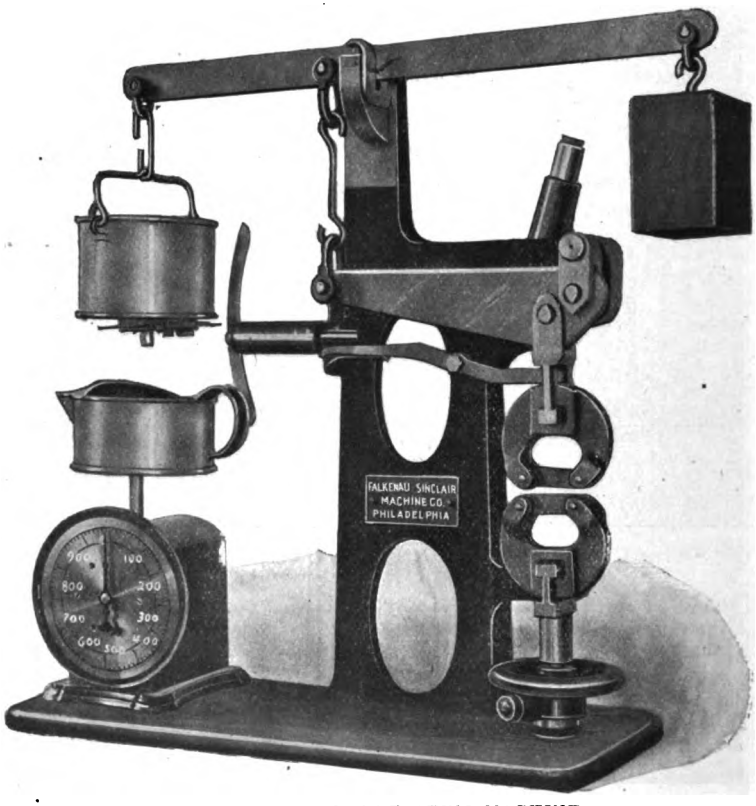
ance a fixed weight hanging at the other end of the lever. The escape of this shot permits a proportionate amount of the weight on the other end of the lever to act on the test specimen. It is seen, therefore, that the essential working principle of the old shot machine is reversed.

The reservoir for the shot has heretofore been placed in a vessel carried on the frame of the machine, or an independent frame, and is fitted with a gate

ceptacle after the specimen has broke and is weighed with the shot whi broke the specimen, and to this exte the result of the test is falsifie With a poor mechanism for closing t gate, this false result is seriously aggr vated. Again the shot falls through certain space from the gate of the rese voir to the receptacle, and, being act on by gravity through this distance, acquires a certain momentum, which not taken into account, but which h



AUTOMATIC CEMENT TESTING MACHINE.

to cut off the escaping stream of shot. This gate is automatically closed at the time the specimen breaks, or as near that instant as the designer has been able to make the mechanism operate. It is obvious, however, that even if the designer succeeded in closing the gate at the instant the specimen broke, there would still be a stream of shot in the air ex-

more or less affected the breaking of t specimen.

In the new machine the shot does n apply the load directly, but indirect that is to say, the shot escaping fr one end of the beam permits the weig which applies the load to act. This fe ture obviates the two objections me tioned above, as the column of shot

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of the beam has practically no momentum at the time it passes the gate, and what momentum there is is not transferred to the test specimen. This escape of the shot takes place very smoothly, and it is hard to imagine that the load can be applied more smoothly to the specimen than is done in this case.

The arrangement shown in the machine has another advantage in that the gate on the reservoir is closed almost instantly when the specimen breaks. This is done by means of the small arm extending over the upper grip. This arm is really a trigger device which holds back the curved arm shown to the left against a spring. When the specimen breaks, the upper grip jumps a very small distance, about 1-64 inch, and in doing so the curved arm is released and shoots forward, closing the gate.

As shown in the cut, the Falkenau-Sinclair Machine Company proposes the use of a spring balance for weighing the shot. The marking on the dial of this balance shows the pounds per square inch applied to the specimen. It follows, therefore, that when the specimen is broken, the operator has merely to glance at the scale, when the pointer will indicate the result of the test. There is no handling of weights and no calculation is necessary. The test is complete, and the shot can immediately be poured back into the reservoir, when the machine is ready to receive the next specimen. It is a well-known fact that engineers are more or less prejudiced against springs, and this prejudice is in many cases well-founded. The manufacturers contend, however, that in this case such a prejudice should not exist, as the spring in the balance can be tested daily, or even hourly, by placing a known weight in the pan and noting that the reading is correct. The springs in this balance have been known to last for years without perceptible variation, but if at any time a slight adjustment is necessary, an adjusting nut is provided so that this adjustment may be made in a moment's time.

While the manufacturers recommend the use of the spring balance on account of the great saving in time, it is well to call attention to the fact that any method of weighing the shot can be adopted, and if so desired, beam scales will be substituted for the spring balance. Of course, in that case it will be necessary for the operator to go through a weighing operation after each test.

The machine is designed for 1,000 lbs. capacity, but a large machine is now under consideration. In designing the machine an effort was made to make it so rigid that no second hitch would be necessary after once starting the test. We mean by this that the grips, levers, frame, etc., are so abundantly stiff that the travel of the weight through a moderate arc is sufficient to break any specimen up to the full capacity of the machine, and it is not necessary to pull down the specimen by hand wheel in order to complete the test. The builders of this machine will be pleased to give further information to any engineers interested, as they think they have a thoroughly reliable automatic testing machine.

Bedell's Curb at the St. Louis Exposition.

The readers of Municipal Engineering when they visit the Great World's Fair should not fail to see Bedell's Concrete Sewer Caps and Lock-joint Curbstones exhibited by the St. Louis Granitoid Curbstone Company north of the Liberal Arts Building and east of the Wireless Telegraph Station. The company has made an excellent start in its business in St. Louis both with the sewer caps and curbing and seems to be giving the best of satisfaction. For particulars address J. E. Bedell, Patentee, 1909 Lafayette-ave., St. Louis, Mo.

A Dump Wagon for Garbage.

The Day dump wagon, made by the Columbia Wagon Company of Columbia, Pa., is so designed that it makes a clean dump and is specially valuable for hauling garbage and refuse on this account. It is quite a saver of labor also, as only one man is needed to a wagon. The wagon is made with 2 yards and 1.5 yards capacity for regular stock and other sizes can be built to order. Elizabeth, N. J., uses five of the wagons for hauling all its garbage. W. C. Owens, jr., the Brooklyn contractor for removal of refuse, has many of them in use.

Pratt's Cement Posts.

In a recent number of Municipal Engineering will be found a description of Pratt's cement fence post, which promises to be a valuable business proposition for one who will take the trouble to show its strength and its durable qualities to the railroads, interurban and

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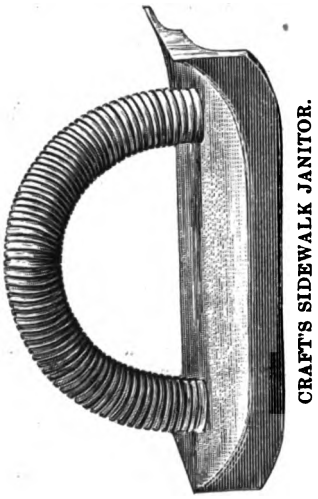
steam, and to the farmers, who are greatly in need of a post which will not rot or disintegrate and which will b strong enough to perform its duty. These are the characteristics of well-made cement posts reinforced with steel. M Leverette A. Pratt, Bay City, Mich., announces that he is now ready to sel county and State rights for the sale o his post. Some drawings and photographs showing its structure will be found on an advertising page of this number of Municipal Engineering.

Finishing Tools for Cement Walks.

A personal inspection of the line of tools made by F. H. Crafts of 97 Glendale



CRAFT'S SIDEWALK JANITOR.

Park, Rochester, N. Y., for finishing artificial stone walks leads us to call special attention to their excellence, both in material and workmanship. Mr. Crafts now has his tools on sale by good firms in nearly every city in North America, and they can be obtained directly from him if not found at the nearest hardware store. The accompanying illustrations show a line roller and a joint finisher. Several styles of each can be obtained. A catalogue of the tools will be

caused us to make some changes in i causing a delay in sending copies parties that have made inquires for them As soon as they are ready they will b forwarded to all requesting them. Ou advertisement in Municipal Engineering has brought a large number of inquiries that have not been answered owing t the change in the company. Every on that has made an inquiry will receiv an answer as soon as the office force ca get to them. Hoping to receive an in quiry from any one that is interested i the use of concrete for buliding purposes we remain your servants,

MICHIGAN IRON WORKS.
Per W. E. Brown, Supt.

Trade Publications.

The F. W. Braun Company of Los An geles, Cal., issues a valuable little pam phlet on annealing, hardening, tempe ing and case-hardening, at the same tim setting forth the advantages of Braun portable forge and tempering furnace.

The United States Drying Engineering Company, 66 Beaver-st., New York, send a catalogue of dryers, digesters an presses as samples of the designs whic they make and the machinery which the

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rubber belt conveyor catalogue illustrates sectional conveyors manufactured under the Anderson patents by the Jeffrey Manufacturing Company, Columbus, O.

Catalogue No. 62 of the Contractors' Tool Company, 704 Arch-st., Philadelphia, Pa., lists cement workers' tools and supplies.

A. D. Mackay & Co., 404 Chamber of Commerce, Chicago, Ill., issues a catalogue of the Winget concrete building block machine, which contains a list of the many forms of plates provided for different designs of face and form of blocks necessary to suit all conditions and tastes. It also contains much valuable information on the mixing of concrete, the operation of the machine and the design and construction of special forms.

The Hercules cement stone machine is illustrated in a catalogue issued by the Century Cement Block Machine Company, 20 Canal-st., Rochester, N. Y. It also contains a list of the doors, cores, etc., shipped with each machine for making various sizes and designs of blocks and faces.

Catalogue 085 of the C. W. Hunt Company, West New Brighton, N. Y., is devoted to coal handling machinery.

Dragon Portland Cement is the subject of an illustrated pamphlet issued by the Lawrence Cement Company, 1 Broadway, New York, which contains much valuable information on the manufacture, testing and use of Portland cement and of Dragon brand in particular.

Trade Notes.

ASPHALT.

Asphalt has been discovered on Table Mountain, near Cape Town, South Africa. It is estimated that the deposit contains approximately 500,000 tons. An experimental pavement has been laid on one of the streets of Cape Town and is reported as satisfactory.

The F. D. Cummer & Son Company, Cleveland, O., has just closed a contract with the McCarthy Improvement Company of Davenport, Ia., for one of its Cummer portable railroad asphalt paving plants, 1904 type, which will have a capacity for turning out not less than 2,000 yards of 2-in. topping per day of 10 hours.

Hetherington & Berner, Indianapolis, Ind., have closed a contract with the city of Detroit, Mich., for an asphalt plant.

The Pan-American Company, 17 Battery-place, New York City, has been organized to acquire and develop the asphalt deposits of the gulf coast of Mexico, on the lands adjacent to the Laguna de Temeahua, between Tuxpan and Tampico. A. L. Barber, formerly of the Barber Asphalt Company, is the chief promoter of the new enterprise.

BRICK.

W. G. Wagenhals, general manager of the Ohio River & Columbus Railway Company, 93 Perin-st., Cincinnati, O., advises us that the company has an excellent market for building brick and desires to communicate with any one in the brick industry who would be interested in putting in a plant at Ripley. A large plant of this kind is now in existence across the river on the C. & O. R. R. at Dover, whose output is ten cars per day. The same quality of clay is found at Ripley and the company would like to get some practical person or persons interested, and if necessary the directors of the company would take an interest in the business.

CEMENT.

The Lancaster Portland Cement Company, Lancaster, Pa., will erect a plant for the manufacture of cement.

The Chanute Cement and Oil Company was granted a charter in Maine recently, capitalized at $6,000,000. The corporation will include the Bronson Cement Co.'s plant, at Bronson, Mich., which is owned by parties at Akron, O. The largest plant will be built at or near Chanute, Kas., where the company owns 5,000 acres of gas and oil leases and 400 acres of shale, limestone and clay lands. The combine expects to furnish a large portion of the material for the construction of the Panama canal. F. M. Atterholt of Akron and capitalists from Akron, Michigan, Minnesota and Missouri are interested in it.

The Carolina Portland Cement Company of Charleston, S. C., has established an office in New Orleans at 308 Baronne-st. The company also has a warehouse on the river front and one in the city. Joseph S. Hanahan, jr., will act as temporary manager.

The dealers in stone, lime, cement, sand, crushed stone, rubble, gravel and other building and street materials, of Chicago, have formed an association to be known as the Association of Manufacturers and Dealers in Building Material.

The Ohio & Kentucky Cement Company has been organized and will manufacture cement near Mentor, Ky., about 20 miles east of Newport. A large plant will be erected.

The large factories of the International Portland Cement Company, under construction near the city of Hull, Quebec, are nearing completion.

A cement plant will be built at Neodesha, Kas., out at Little Bear Mount Robert Nesch of Kansas City and Mr. Cruikshank, vice-president of the Union Cement Company of Ohio, are promoting the company. The concern will be known as the American Portland Company.

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Work on the plant will probably begin in June.

A new cement company, to be known as the American Cement Company, is being organized in Philadelphia.

The Selma Portland Cement Company of Boston has purchased from J. F. Milhous a tract of land west of Orrville, Dallas County, Ala., and will erect a cement plant at a cost of about $600,000. The officers of the company, who are all of Boston, are as follows: President, Frank D. Sanborn; vice-president, Edward M. Heustis; treasurer, Edwin L. Hoag; secretary, Isaac C. Bunnell; attorney, Francis M. Carroll.

The Pennsylvania Portland Cement Company has let contracts for erecting a Portland cement plant at Newcastle, Pa. The officers of the company are: President, E. I. Phillips; vice-president, E. N. Ohl; secretary and treasurer, Edwin F. Norris; superintendent, H. E. Brown.

A creditors' bill was filed in the Circuit Court at Chicago, May 4, making charges of fraud in the wrecking and reorganization of the Marquette Cement Company, operating a $500,000 plant at La Salle, Ill.

The appointment of a temporary receiver for the Midland Portland Cement Company pending the court's decision as to the reorganization of the company has been asked for at Indianapolis. According to the complaints filed a receiver was asked for to head off a combine of certain stockholders and outsiders who new understanding that the new corporation assume all of the liabilities of the old one, other than the claims of the common stockholders, and that the Bedford plant be completed and put on a paying basis. A company had already been organized and a written contract for the disposal of the stock of the old company to a new one was signed by E. W. Shirk, F. M. Talbot, E. I. Fisher, V. O. Fulk and A. L. Layman. These men propose to organize a new company to be composed of themselves and others, and to buy the assets of the old company unare preparing to sell the company out to a holding company for the purpose of freezing out the minority stockholders. The defendants denied that there had been any attempt on the part of the majority stockholders to deprive the plaintiffs or any others of their interests in the corporation. As shown in the answer the tangible assets of the company amount and one about six miles west of Hancock Md.

A committee of the American Associa tion of Cement Manufacturers visited St Louis recently to complete arrangement for the cement exhibit at the Louisian Purchase Exposition. The committee i composed of John B. Lober of the Vul canite Portland Cement Company, R. W Lesley of the American Cement Company Philadelphia, Pa.; E. R. Ackerman of th Lawrence Cement Company, Ne York: W. R. Warren of the Vir ginia Cement Company, Richmond Va.: D. McCool of the Newaygo (Mich. Portland Cement Company; C. F. Wade Omega Portland Cement Company; S. E Newberry, Sandusky Portland Cemen Company, and J. C. Robinson, St. Loui Portland Cement Company.

Mr. I. J. Mensch of Chicago is buildin a ten-story manufacturing building, 68 b 335 feet in plan, for the Pugh power plan in Cincinnati, O., which is said to be th largest concrete building ever attempted and to have no wood or structural stee in its construction, everything being o reinforced concrete, and such trimming as window sashes of sheet iron. Th basement walls, eighteen feet deep, ar six inches thick and the outside walls ar four inches thick, with reinforced con crete pilasters.

The American Portland Cement Com pany of Kansas City, Mo., noted in th third edition of the "Directory of Ameri can Cement Industries" as about to in corporate, has now an officia' existence C. A. Brockett is interested in the com pany.

CONCRETE BLOCKS.

W. C. Herman has purchased the ce ment business formerly conducted by th Sumption Sidewalk Company at 116 N Market-st., Wichita, Kas.

The Ohio Concrete Company, Canton O., has been incorporated by Alvin Hur ford, J. N. McQueen, Attel Pomerene Homer V. Briggle and E. B. Hurford.

The St. Louis Hollow Concrete Bloc Construction Company, St. Louis. Mo. has been incorporated to manufactur hollow concrete blocks by L. Frank Ot tofy, E. E. Posey and R. J. Winsor.

A company has been formed at Ash land, Wis., by Thomas Edwards and oth ers to manufacture hollow bricks.

The Thief River Falls (Minn.) Ston and Cement Company has been organize

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gaged in the manufacture of concrete building blocks.

Olson & Skoolheim, Willmar, Minn., will manufacture cement blocks.

The manufacture of concrete blocks is contemplated by Anton Evanstad and George B. Finley at Lakota, N. D.

The Manhattan Paving Company, Faribault, Minn., will manufacture hollow concrete blocks and tile squares for sidewalks.

J. J. Baskerville, Cando, N. D., will manufacture concrete hollow blocks under the Miracle patents.

The Indestructible Post Company, Chicago, has been organized to manufacture steel fence posts with cement foundations. The officers of the company are as follows: President, G. H. Jones; vice-presidents, Harry Burrell and H. E. Speyer; secretary and treasurer, Chas. Blackburn; general manager, H. E. Speyer. The company will erect plants at Pennville, Ind., and Texas.

George and Will Fulton, cement block manufacturers at Hartford City, Ind., may purchase another concrete block machine.

A. T. Bramer & Sons, Monett, Mo., advises us that they are interested in the question of concrete block machines, and will purchase one in the near future for manufacturing artificial stone.

The F. M. Ladd Company, building construction and cut stone contractors, New London, Conn., advises us that they desire the names of cement block machine makers.

James Muir, 347 Bay-st., Springfield, Mass., advises us that he is interested as a possible purchaser of crushing and pulverizing machines.

Lake Erie Concrete Company, Painesville, O., has recently organized a company to manufacture artificial stone This plant is being equipped with Hercules machines.

R. H. Brady is erecting a large armory at Wilmington, N. C., of hollow cement building blocks. The Hercules method is adopted.

Vance & Lawson of Springfield, Ill., one of the largest artificial stone manufacturing firms in this country, have recently contracted with the Century Cement Machine Company to install Hercules cement stone machines in their plant.

The Hollodaysburg Manufacturing Company, Hollidaysburg, Pa., has ordered more Hercules machines in order to supply the demand for hollow blocks.

F. H. Longley, Fairport, N. Y., is erecting a large factory for the Cobb Preserving Company. Hollow cement building blocks made by the Hercules method are being used.

E. C. Mack, Aiton, Ill., has adopted the Hercules method for making artificial stone.

J. T. Garland, Deadwood, S. D., advises us that he is in the market for sidewalk and paving tools.

K. F. Graham, 43 Haskell-st., Westbrook, Me., writes us that he is in the market for machinery to handle and mix cement.

Homer Ventre, Opelousas, La., advises that he desires to purchase woodworking and brick machinery.

PURCHASE OF MATERIALS.

Homer Ventre, Opelousas, La., advises us that he is a possible purchaser of lumber, cement and brick.

John Fraser, 420 Lake-st., Bellingham, Wash., advises us that he is a possible purchaser of cement, stone, brick, etc.

Charles E. Crowell, South Dennis, Mass., is interested as a possible purchaser of Rosendale and Portland cement.

LIGHTING AND POWER.

The Penn Electric Equipment Company Camden, N. J., has been incorporated by B. L. Cater, G. C. Rawson and W. C Rawson.

The Gas Consumers' Protective Association, New York City, has been incorporated by M. Fitzgerald, M. D. Fitzgerald and P. F. Riordan.

Newly incorporated companies: Consumers' Gas Company, Rushville, Ind.; Lindsay Light Company, Chicago, Ill.; Welsbach Street Lighting Company, Lincoln, Neb.; People's Individual Gas Company, Washington, D. C.

MISCELLANEOUS.

The Lake Superior Corporation, 245 Washington-st., Jersey City, N. J., has been incorporated by Charles E. Orvis, Edward White and William F. Hobbie to lease, construct and operate canals, sell water from the same and sell all kinds of power.

Oscar Schneider and George Haun, jr., Winona, Minn., have formed a stone company.

The Union Trust Company has been appointed receiver for the Home Heating and Lighting Company at Indianapolis, Ind. The operation of the plant will be continued by the receiver.

The Armored Concrete Construction Company, Baltimore, Md., has been incorporated by Isaac S. Filbert, Hugh Sisson, Henry B. Wilcox, Ferdinand Barre and Alfred E. Mealy for building bridges, wharves, docks and other structures.

The Standard Drainage Company, Windom, Minn., has been incorporated to engage in the construction of ditches, drains and water courses by J. A. Bernard, J. T. Johnson and J. K. Moen of Windom and T. M. Stuart of Brilton, S. D.

The Erie Steam Ballast Company, composed of capitalists from Van Wert, O., have established a stone-crushing plant east of Huntington, Ind., where a deposit of stone suitable for ballast has been found near the Western Lime Company's plant.

The Delphi Crushed Stone Company, Delphi, Ind., has been incorporated by J. B. Miller, F. W. Disbrow, Julius Stern and Edward Bliven.

Julian Scholl & Co. of New York City have purchased the plant of the Diamond

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Truck Company, at Kingston, N. Y., and will refit it at once for the manufacture of road-making machinery.

The Toledo Reduction and Fertilizing Company, Toledo, O., has been organized and will be incorporated with $200,000 capital. The company represents a merger of two competing garbage disposal concerns. The officers are: President, M. I. Wilcox; vice-president, C. E. B. Lamson; secretary-treasurer, Peter Parker; general manager, Isaac Gerson.

A. Leschen & Sons Rope Company has been compelled to seek larger quarters in New York City and have taken the large offices at 163 and 165 Washington-st., where they have increased facilities carrying a very much larger stock in the past and opened their new commodious offices on the morning May 2. Their large new manufactu plant with their main offices are loc at St. Louis, Mo., with branch office Chicago, Denver and San Franc A. Leschen & Sons manufacture grades and kinds of rope and are the manufacturers of Hercules and Pa Flattened Strand Wire Rope, and furnish Aerial Wire Rope Tramway fits of all kinds and likewise incline face and underground wire rope hau outfits.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Newcastle, Ind.—Suit was filed in Superior Court at Indianapolis May 18 to determine the right of this town to assess the cost of paving between the tracks of the street railway. The suit was filed by the Barber Asphalt Paving Company against the Indianapolis & Eastern Railway Company and the town of Newcastle. The assessment roll for the paving of Main-st., $1,357.10, was charged against the railway company for the improvement between its rails. The company refused to pay the asphalt company, holding that the town had no legal right to assess it for the improvement.

New Albany, Ind.—A bill of complaint was filed in the United States Court at Indianapolis May 4 by the Barber Asphalt Paving Company of West Virginia against this city in which an injunction was asked by the company to prevent the city from ordering vitrified brick paving for Vincennes-st., and to compel the railroad and traction companies in that street to lower their tracks to permit the paving of the street with asphalt. The company's attorneys claim that the Barber Asphalt Paving Company was awarded contracts last summer for paving four streets. The work was to be finished in November, but the time for

CONTEMPLATED WORK.

Hazelton, Pa.—Paving is proposed Wyoming-st.

Fremont, O.—Paving is contempl W. State-st.

Hope—N. D.—Cement walks are templated for Steele-ave.

Sandy Hill, N. Y.—This city voted t sue $15,000 bonds for paving.

Woonsocket, R. I.—The macadam of School-st. is contemplated.

Cambridge, O.—An ordinance has passed for paving N. Seventh-st.

Manchester, Ia.—Council will con paving for Franklin-st., June 6.

Lowell, Mass.—A petition for pa Middle-st. is being circulated.

Lebanon, Ill.—Contracts will be le June for 2,000 ft. of paving.

Camden, N. J.—Asphalt paving is sired for King and Chestnut-sts.

Oskaloosa, Ia.—A resolution has passed to pave N. B-st. to A-ave.

Oneida, N. Y.—Resolutions have passed for building stone or con walks.

Stuttgart, Ark.—Contracts will be soon for 30,000 sq. ft. of concrete walk.

Ft. Plain, N. Y.—Brick paving is templated for one or more streets

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Litchfield, Ill.—Bids will be asked for about 20 blocks of paving. Wm. Bates, cy. engr.

Waynesboro, Pa.—The construction of about 3-mis. of pikes is contemplated.

Sullivan, Ill.—Petitions are being circulated asking for the paving of certain streets.

Haverhille, Mass.—An appropriation of $10,000 has been made for macadamizing River-st.

Effingham, Ill.—Banker, Fourth, and Jefferson-sts. will be paved with two courses of brick.

Troy, N. Y.—The construction of concrete sidewalks on a number of streets is contemplated.

York, Me.—An appropriation of $5,000 has been voted for constructing new roads and grading.

Luverne, Minn.—Council has authorized the construction of a large amount of cement sidewalks.

Oswego, N. Y.—The property owners on W. Third and W. Fourth-sts. have petitioned for macadam paving.

Lagro, Ind.—Cement sidewalks are contemplated for Main, Washington, Brady and Clinton-sts.

Helena, Mont.—About 18,000 sq. yds. of paving is contemplated this year. Chas. W. Helmick, cy. engr.

Warren, O.—Asphalt block paving, with stone curbing, is proposed for E. Market-st. E. M. Milligan, cy. engr.

Jacksonville, Fla.—Mayor Nolan has approved ordinances for paving Main, Ocean and Newman-sts. with brick.

St. Clairsville, O.—The question of paving Main-st. is being considered, according to press reports.

Meriden, Conn.—City engr. Clark has been directed to prepare specifications for macadamizing Hanover-st.

Waverly, Ia.—A resolution has been passed, according to press reports, for paving 7 blocks of streets.

Cleveland, O.—Ordinances were approved, May 19, for paving a number of streets with brick. Peter Witt, cy. clk.

Columbus, O.—An effort is being made to have Long-st., from Grant-ave. to 20th-st., resurfaced with block stone.

Hinsdale, Ill.—Contracts will be let about June 15 for macadam paving and street drainage. Wm. Duncan, vil. clk.

Petoskey, Mich.—The property owners on a large number of streets have petitioned for cement walks. R. M. Minston, mayor.

Rock Falls, Ill.—Ordinances have been passed for constructing about 3-mis. of concrete sidewalks at a cost of $7,000.

Albany, N. Y.—Ordinances are pending providing for the paving of a number of streets with macadam, brick and asphalt.

Jerseyville, Ill.—Contracts will be let about July 15 for paving 32 blocks of streets with brick. E. B. Shafer, cy. engr.

st., have petitioned for asphalt block paving on gravel base.

San Francisco, Cal.—Basalt block paving on concrete is contemplated for Mission-st. from East-st. to Fifth-st., and asphalt from Fifth to Ninth-sts.

Meadville, Pa.—The plans of the city engineer for paving Chestnut-st. from Market-st. to Diamond Park, have been accepted. Mayor Reynolds.

Newark, O.—Brick paving on gravel base, with sandstone and artificial stone curb, is contemplated for Locust and Granville-sts. and Woods-ave.

Monticello, Ill.—Contracts will be let in July or August for paving Walten and Manor-sts. with sidewalks and gutters. Robt. Laurie, cy. engr.

Tacoma, Wash.—Asphalt paving, the construction of sidewalks and a masonry retaining wall is contemplated for C-st. Wm. Welch, comr. pub. wks.

Newark, N. J.—Ordinances have been passed for paving Seymour and Peshine-aves. and Johnson, Hermon, Bigelow, and New-sts. with granite, brick or macadam.

Ogden, Utah.—Ordinances have been adopted for constructing concrete sidewalks on Washington-ave. from Twenty-second to Twenty-sixth-sts. W. J. Critchlow, cy. recorder.

Columbus, O.—Resolutions have been passed providing for the construction of brick, stone, asphalt or cement sidewalks on a number of streets. John T. Barr, clk.

Rosedale, Kas.—The City Engineer has been directed to prepare plans for the further paving of Kansas City-ave., which is an extension of the Southwest-boulevard.

Newport, Ky.—The property owners on Sixth-st., between Washington-ave. and Overton-st., have petitioned for brick paving and cement curbing. Peter Krebs, cy. clk.

Birmingham, Ala.—Remonstrances and protests will be heard June 15 on ordinances for paving sidewalks and macadamizing a number of streets. W. M. Drennen, mayor.

Montgomery, Ala.—Ordinances were adopted May 19 providing for the construction of vitrified brick, Shillinger or hexagon block sidewalks. Thos. C Carr, mayor.

Benton Harbor, Mich.—Plans and specifications have been accepted and objections will be heard June 4 for paving Napier-ave. with brick and Lake Shore-drive with macadam.

Troy, N. Y.—Asphalt paving is contemplated for the intersections of Hoosick-st. and Fifth-ave., State and First-sts., State and Second-sts., State and Third-sts. and State and Fourth-sts.

Springfield, Mass.—The board of selectmen voted to pave Old Bridge and

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and Conti-sts. with asphalt. Paul Capdevielle, mayor.

Marshalltown, Ia.—Council adopted resolutions May 9 for paving 2nd, 3rd, 4th and 5th-sts. with asphalt.

Glens Falls, N. Y.—The taxpayers voted to issue $15,000 bonds for completing the paving work.

Green Bay, Wis.—Resolutions have been passed for paving Main, Adams and Cherry sts. with vitrified brick, Mather-st. with macadam, and putting a top-dressing of granite on Porlius, Jefferson and Cherry-sts.

New Brunswick, N. J.—Asphalt paving is desired on Albany-st.

Milton, Pa.—Several blocks of vitrified brick paving is contemplated

Knoxville, Tenn.—The question of issuing bonds for paving the streets will be voted on.

Oelwein, Ia.—Asphalt paving and brick gutters is contemplated for the business section.

Des Moines, Ia.—Asphalt paving is proposed for Walnut-st., between Des Moines River and 14th-st.

Lyons, N. Y.—The village bd of trustees has authorized Comr. Halstead to macadamize Elmer-st.

Harrisburg, Pa.—Ordinances have been introduced for paving Maclay, Fourth and Reily-sts. and Haehnlen-ave. and Fahnstock alley.

Toledo, O.—The cy. engr. has been directed to prepare legislation for paving Columbia, Batavia, Winthrop, Machen, Putnam and other streets.

Cincinnati, O.—Ordinances have been pased for paving a number of streets with vitrified brick, bowlders, macadam, asphalt and granite blocks.

Danville, Ill.—The bids received May 14 for paving Jackson, College, Ann and Robinson-sts. were rejected as too high and new bids will be received.

St. Paul, Minn.—Estimates have been submitted for paving E. Fifth-st., from Broadway to Kittson, with sandstone, and Sibley and Eighth-sts. with asphalt.

Auburn, N. Y.—The special com. has recommended paving for North-st. and Hamilton-ave. from South to Mary-sts., and E. Genesee-st. from Seward-ave. to the city limits.

Dayton, O.—Resolutions were adopted May 16 for paving certain streets with boulders, grading and graveling and for

until June 4 for improving Page-st. fro Main to B. W. H. Linderud, cy. clk.

Huntingburg, Ind.—Sealed bids ar asked until 4 p. m. June 6 for improvin certain streets. Aug. F. Becker, cy clk.

Danville, Pa.—Sealed bids are aske until June 13 for constructing 4,550 f of road. State Highway dept., Harris burg.

Lawrence, Kas.—Sealed bids are aske until June 6, for grading, paving an curbing Ohio-st. S. P. Moore, cy. clk.

Vicksburg, Miss.—Sealed bids are aske until June 6, for paving Washington-s with vitrified brick. W. L. Trowbridg mayor.

Columbus, Ind.—Sealed bids are aske until June 6, for gravel roads. John Gan chmn. co. comrs.; Wm. A. Morris, c audt.

Roanoke, Va.—Sealed bids are aske until June 12, for grading Day-ave., b tween Third-st. and Franklin road. J. H Wingate, cy. engr.

Brownstown, Ind.—Bids are asked, u til June 7, for constructing about 20 mil of gravel and macadamized roads. A bury Manuel, co. audt.

Cleveland Heights, O.—Sealed bids ar asked, until June 14, for paving with ma adam, Bellfield and Grandview-ave. Wm Phare, vil. clk.

Canonsburg, Pa.—Sealed bids are aske until June 6, for paving Belmont-av with vitrified brick and 1,000 feet wit macadam. W. C. Black, boro clk.

Greensburg, Ind.—Sealed bids ar asked, until June 6, for constructin gravel roads in Fugit, Sandcreek ar Jackson twps. Frank E. Ryan, co. aud

Albany, N. Y.—Sealed bids are aske until June 6 and 10 for constructing number of improved highways. H. A Van Alstyne, State engr. and surv.

Olathe, Kas.—Sealed bids are asked unt June 14 for paving Kansas-ave. with vitr fied brick and constructing cement curb ing. C. F. Garwood, cy. clk.

Louisville, Ky.—Sealed bids are aske until June 3 for paving Dumesnil-st., fro Twenty-sixth to Amber-sts., and Dougla ave., from Dudley to Everett-aves., wit asphalt.

Cincinnati, O.—Sealed bids are aske until June 7 for macadamizing Marshal ave. and paving Watson-st. with vitrifie brick. Geo. F. Holmes, clk. B. P. S.

Washington, D. C.—Sealed bids ar asked until June 7 for constructing a sys

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3 mls. long. John Guire, dir.; Peter Forman, engr., Manaplan.

Buffalo, N. Y.—Sealed bids are asked until June 7 for repairing all asphalt pavements out of guarantee and not beyond repair, for the fiscal year. Francis G. Ward, comr. pub. wks.

Deadwood, S. D.—Sealed bids are asked until 4 p. m., June 6, for 20,000 sq. yds. of brick paving and 8,000 lin. ft. of stone curbing on Main, Lee and Deadwood-sts. John Treber, chmn. com. impvts.

Indianapolis, Ind.—Sealed bids are asked until June 8 for grading and graveling certain streets and paving sidewalks on Noble and Newman-sts. with cement. M. A. Downing, chmn. B. P. W.

Petersburg, Ind.—Sealed bids are asked until June 3 for grading, paving with stone, curbing and gutters, sub-drainage and catch-basins on Main-st., from Twelfth to Eighteenth-sts. Leslie Lamb, prest. bd. town trustees.

Mt. Airy, O.—Sealed bids are asked until June 13 for constructing cement sidewalks on Mt. Airy and North Bend roads and Belmont-ave. Jos. Steele, cil. clk.; J. A. Stewart, vil. engr., 813 Traction Bldg., Cincinnati.

Highland, Ill.—Sealed bids are asked until June 4 for furnishing macadam, sand, paving bricks, extra hard crossing bricks and cement; also for laying bricks of sidewalks and crossings per 1,000 as required during the year. Christian Koch, chmn. st. and alley com.

Brooklyn, N. Y.—Sealed bids are asked until June 8 for repaving a number of streets with granite block on concrete base, and asphalt. Also for furnishing and delivering 388 cu. yds. of paving gravel and 350,000 lbs. of paving pitch. Martin W. Littleton, prest. boro.

Richmond, Ind.—Sealed bids are asked until 4 p. m. June 6 for constructing Starr brick or cement sidewalks on S. Ninth-st., from S. E to S. H, and S. F-st., from S. Eighth to S. Ninth-st.; constructing cement curb and gutters and sidewalk intersections on S. Thirteenth-st., from S. B to S. C-st. John F. Taggart, cy. clk.

Roanoke, Va.—Bids are asked, until June 12, for grading Day-ave. J. H. Wingate, cy. engr.

Mitchell, S. D.—Bids are asked, until June 6, for grading Burr-st. J. G. Markham, cy. audt.

Lima, O.—Bids are asked, until June 13. for paving Jackson-st. with vitrified brick or block. O. J. Rose, clk.

Canonsburg, Pa.—Bids are asked, until June 6, for 2,200 sq. yds. of paving on Belmont-ave. W. C. Black, boro. clk.

Bridgeport, Pa.—Sealed bids are asked, until June 7, for paving DeKalb-st. with vitrified brick. David Wilson, chmn. st. and rd. com.

Toledo, O.—Bids are asked, until June 20, for paving Fifth-st. with vitrified brick, and for repaving Eighteenth-st. Harry S. Jones, secy. B. P. S.

Cincinnati, O.—Sealed bids are asked until June 21 for macadamizing Madison-road from Woodburn to Observatory-aves. George F. Holmes, clerk B. P. S.

Lafayette, Ind.—Sealed bids are asked until June 13 for paving Grant-st., from South to Scott, with brick, with cement sidewalks. Charles F. Williams, city clerk.

Reynoldsville, Pa.—Sealed bids are asked until June 15 for grading, paving and curbing Main-st., from east side of iron bridge to Seventh-st. L. J. McEntire, clerk council.

Alliance, O.—Bids are asked until June 16 for 28,500 square yards of macadam paving, 1,345 feet brick street crossings and 17,500 feet cement curb and gutter. R. P. Lentz, secretary.

Washington, D. C.—Sealed bids are asked until June 11 for furnishing asphalt paving blocks, terra cotta sewer pipe and branches, vitrified sewer invert blocks, rectangular repressed vitrified sewer invert bricks, Portland cement, granite curbing, repressed vitrified paving blocks, red sewer brick and sand and gravel. H. B. MacFarland, chairman District Commissioners.

CONTRACTS AWARDED.

Youngstown, O.—The contract for building artificial stone sidewalks was awarded to J. H. Chambers.

Tipton, Ind.—The contract for constructing a gravel road was awarded to A. J. Lacey for $2,400 per mi.

Pana, Ill.—The contract for paving 19 blocks of streets was awarded to John E. Bretz at $1.76 a sq. yd.

Houghton, Mich.—The contract for brick paving on Shelden-st. was awarded to J. J. Byers & Co. for $28,314.

Rochester, N. Y.—The contract for paving the public market was awarded to Dennison & Co. for $87,063.

Cleveland, O.—N. M. Platten secured the contract for one a half miles of sidewalk on Lorain-st. for about $10,000.

Wilmington, N. C.—The contract for paving Fourth-st. with brick was awarded to Roger Moore at $1.71 a square yard.

Peoria, Ill.—The contract for paving Reed-ave. with brick has been awarded to Dunbar & McAllister for $10,705.

Marion, Ind.—L. C. Lillard was awarded the contract May 19 for paving McClure-st. with brick at $8.45 a lineal foot.

Cooperstown, N. Y.—The contract for 25,000 square feet of cement walks was awarded to E. A. Rotter of this city for $3,000.

Shelbyville, Ill.—The contract for eight blocks of brick paving was awarded to Morrisey & Porter of Peoria for $17,709.58.

Champaign, Ill.—John W. Stipes has been awarded the contract for paving Elm-st., from University-ave. to Green-st., with brick.

Ypsilanti, Mich.—The contract for constructing sidewalks was awarded May 20 to R. P. Baker of Port Huron for about $15,000.

Atchison, Kas.—The contract for grading, paving and curbing Parallel-st. from Seventh to Twelfth-sts. was awarded to George Graves, for $26,955.28.

Columbus, O.—The contract for paving

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E. Broad-st. from Woodland-ave. to Alum Creek has been awarded to the Cleveland Trinidad Paving Company.

Minneapolis, Minn.—The Republic Creosoting Company of this city was awarded the contract for creosoted wood block paving at $1.71 a sq. yd.

Altoona, Pa.—The contract for paving Eleventh-st. between Chestnut and Fourteenth-ave. has been awarded to W. H. Herr, at $1.20 a sq. yd. for brick.

Brainerd, Minn.—The contract for constructing cement sidewalks in East Brainerd was awarded to Carlson & Bowman, at 80 cts. a sq. yd.

Buffalo, N. Y.—The German Rock Company was awarded the contract, May 12, for paving Lutheran-st., from Broadway to William-sts., with asphalt, for $3,820.

Ventnor, N. J.—The contract for paving Atlantic-ave., from Newport to Jackson-aves., with macadam, has been awarded to R. J. Shenley of Newark.

New Orleans, La.—The C'cilian Asphalt Pacing Company was awarded the contract for repaving S. Rampart-st., from Canal-st. to Tulane-ave., with asphalt.

Augusta, Ga.—The Georgia Vitrified Brick & Clay Company was awarded the contract, May 13, to pave Broad-st. with vitrified brick for $67,012.30.

New York City—The M. Baird Contracting Company has been awarded the contract for paving Broadway-st., from Canal to Vesey-sts., with granite blocks, for about $46,000.

Springfield, Ill.—The contract for paving Seventh-st. with brick was awarded to Nelch & Patterson at $1.48 a sq. yd., and for paving Sixth and Cass-sts., to John E. Bretz.

Buffalo, N. Y.—Special.—The German Rock Asphalt & Cement Company, 306 D. S. Morgan Bldg., has been awarded the contract for paving Broadway, from Jefferson to Herman, for $21,900.

Cleveland, O.—The Cleveland Trinidad Paving Company was awarded the contract for paving St. Clair-st., from Becker-ave. to the boulevard, with Medina block stone, for $35,504.30.

St. Charles, Mo.—George L. Heckmann has been awarded the contract for paving Second-st., from Clay to Clark, with brick at $1.675 a square for paving and 48 cents a lineal foot for Bedford limestone curbing.

Detroit, Mich.—The Republic Chemical and Creosoting Company of Indianapolis, Ind., has been awarded the contract for repaving Fourth-st., from Michigan-st. to Grand River, with creosoted wood blocks.

Asheville, N. C.—Paving contracts were awarded May 6 as follows: French Broad-ave. and E. and W. College-sts., Southern Paving and Construction Company; Walnut, Lexington and Cumberland, Warren Brothers' Company of Boston.

Wilmington, Del.—Contracts for m terials and paving Fourth-st., betwe Church and the Christiana River, ha been awarded as follows: Stone, Ste art & Donohue; sand, John M. Solom Belgian block paving, Davis & Broth

Grand Rapids, Mich.—The contract paving N. Union-st. with asphalt blo was awarded May 20 to Kloote & V derveen for $14,389, and the contract improving Earldon-st. was awarded the same company for $1,595.

Woonsocket, R. I.—Warren Bros. Co pany of Boston secured the contract paving Cumberland-st. with bitulit pavement and Main-st. with granite. W. Blakesley & Sons will pave parts Main and Cumberland-sts. with brick.

Cincinnati, O.—Paving contracts h been awarded as follows: Central-a brick, R. H. Fleming of Ludlow, $4,010 Sixth-st., R. H. Fleming, $3,360.34; m adamizing Bodmann-ave., between burn and Alvin-aves., T. L. and H. Gleason.

Grand Rapids, Mich.—Paving contra have been awarded as follows: Grad and graveling S. Union-st, from Fult st. to Wealthy-ave., J. B. Hoey, $8,899; paving Pearl-alley, John H. Su van, $1,258; grading and graveling G den-st., James Sherlock, 3,949.

St. Paul, Minn.—Paving contracts h been awarded as follows: Repairing phalt streets, Barber Asphalt Pav Company, $1.65 a sq. yd. for surfac and $1 for concrete foundations; pav other streets, James Forrestal & Co. cts. a sq. yd. for paving and $1.50 concrete.

Pittsburg, Pa.—Contracts for build about 22-mls. of country roads have b awarded as follows: Booth & Fl Freeport No. 2, $87,339; Troy Hill, $56 M. F. Howley & Co., Kittaning & Dor ville, $107,287; Stoops Ferry and Sho town, $65,588.80; W. W. Kelly, Bosto Greenock, $35,910.

Mobile, Ala.—Paving contracts w awarded May 14 as follows: Granite b paving, Asphalt Paving Company Georgia, $85,362.30; vitrified brick pav W. M. Lasley, Chattanooga, $119,210; phalt paving, Asphalt Paving Compan Georgia, $62,772.80. The contract for w en block paving was not awarded.

Belleville, Ill.—(Special.)—Henry Meeker, cy. engr., says that the tract for paving Race-st. with brick awarded to Hoeffken Bror. of this as follows: Albion block, $1.67¼ a sq. including grading, 4-in. natural cem concrete and 2-in. sand cushion; Bed limestone curbing, 48 cts. a lin. ft.; to $18,273.09.

Kewanee, Ill.—Bids were submitted 20 for constructing 50,000 sq. yds. of ment sidewalks as follows: P An & Co. of Chicago, walks, 13¾ cts. a ft.; drives, 14 cts.; curb walls, 50

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beams, 23 cts.; steps, 41 cts.; grading, 3¼ cents.

Utica, N. Y.—The contract for paving several streets has been awarded to the Interstate Paving Company.

Albany, N. Y.—Paving contracts were awarded May 20 as follows: Northern-boulevard, between Elk and Sherman-sts., Mulberry Bros., $2,858.70; Sherman-st. from Lexington-ave. to Perry-st., Denniston & Co. of Rochester, $15,374.20.

St. Louis, Mo.—Paving contracts were warded May 21 as follows: Henkel & Sullivan, Goodfellow-ave., $24,035.99; Carter-ave., $6,963.75; Lee-ave., $6,899.44; Prairie-ave., two sections, $5,956.10 and $3,331.31. Heman Construction Company, Von Versen-ave., $7,376.60. Gottlieb Eyermann, Hebert-st., $7,319.60. Wm. R. Bush & Co., Nebraska-ave., $13,069; Blaine-ave., $7,719.20. Fruin Colnon, Prairie-ave., $22,485.20.

SEWERS.

Syracuse, N. Y.—John Davin has abandoned the contract for constructing a sewerage system for the village of Skaneateles, the cost of which is to be borne by the village and the city of Syracuse. The contract was for $22,000 and the contractor has done about $10,000 worth of work and has been paid $7,000. The system is 6½ miles in extent and the work done covers about 2 miles.

Toledo, O.—City Solicitor Denman has decided that the legislation for the construction of the Columbus-st. sewer is invalid, and has recommended that all bids for the work be rejected and a report of the conditions made to the common council so that it may begin over again legislation for this piece of work. Bids for the sewer were opened several months ago, but investigation shows that the ordinance was tampered with after it left the solicitor's office, making it invalid. The sewer would have cost about $90,000.

CONTEMPLATED WORK.

Cloverdale, Cal.—A sewerage system is contemplated.

Lancaster, O.—A sewer on Broad-st. is contemplated.

Algona, Ia.—A sewer is contemplated for the south side.

Belview, Minn.—Surveys will be made for a sewerage system.

Morris, Minn.—Council has been asked to secure estimates for a sewer.

Comfrey, Minn.—Bids will be asked soon for building a sewer.

Portland, Me.—An ordinance has been passed for building a sewer in Pickett-st.

Nappanee, Ill.—A sewer will be built this summer. Q. L. Reincohl, town clk.

Rome, N. Y.—Plans have been filed for the extension of the sewerage system.

Belle Plaine, Ia.—The question of building sewers will be voted on June 14.

Wyandotte, Mich.—This city has voted to issue $100,000 bonds for a sewerage system.

Healdsburg, Cal.—The bd. of trustees will adopt the septic tank method of sewage disposal.

Hope, Ark.—Plans are being considered for a sewerage system. C. A. Bridewell, mem. com.

Havana, Ill.—The construction of sewers in Plum-st. and the East End is contemplated.

Ithaca, N. Y.—The bd. of sewer comrs. is considering the filter plan for sewage disposal.

Waterloo, N. Y.—The question of building a sewerage system will probably be submitted to vote.

Harrisburg, Pa.—The mayor has signed the ordinance for constructing sewers in a number of streets.

Dundee, Minn.—A petition will be presented to council asking for the construction of a sewer.

Ridley Park, Pa.—The highway com. has recommended the construction of a sewerage system.

Greensboro, N. C.—Plans for 2 septic tanks, to cost $4,000 and $6,000, respectively, have been submitted.

Philadelphia, Pa.—The survey committee has appropriated $700,000 for the construction of main sewers.

Quincy, Mass.—City coun. has passed an ordinance for $50,000 for sewer extensions. Hamilton Flood, cy. engr.

Monticello, Ill.—The construction of two sewers is contemplated for this summer. Robt. Laurie, cy. engr.

Great Falls, Mont.—Bids will be asked at once for constructing 3,100-ft. of pipe sewers. D. L. Ellis, cy. engr.

Butler, Pa.—An ordinance has been approved for constructing a sewer in Monroe-st. R. S. Cornelius, prest. town coun.

Aberdeen, Miss.—The question of issuing bonds for the construction of a sewerage system wil be voted on June 14.

Canastota, N. Y.—E. A. Fisher of Rochester, will be engaged to confer with regarding the construction of a sewerage system.

Pontiac, Mich.—W. J. Fisher, cy. engr., has been directed to prepare plans and maps for sewers for the eastern part of this city.

Ballston Spa, N. Y.—The extension of the main sewer for about 2-mis. and the building of lateral sewers throughout the town is contemplated.

Lestershire, N. Y.—The residents of Main-st. have asked the village trustees to construct a trunk sewer in the business section of town.

San Pedro, Cal.—A resolution of intention to build sewers in blocks 55, 56, 74, 75 and 76 have passed first reading. Bd. cy. trustees.

Butler, Ind.—New bids will probably be received about June 10 for constructing a combined sewerage system for the urban and suburban districts.

Houston, Tex.—The question of issuing $650,000 bonds for the construction of a sanitary and storm water sewerage system will be voted on June 27.

West Hoboken, N. J.—The West Hoboken Council and the Weehawken twp.

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com. met May 12 as a joint board to consider plans for the proposed joint relief sewer. The estimated cost is $49,275.

Buffalo, N. Y.—Special.—The property-owners in South Buffalo have organized for self-protection and in opposition to the proposed $75,000 trunk sewer from Buffalo River, through Bertha, Germania, Tifft and Hopkins-sts. to Amber-st.

Sylcauga, Ala.—Special.—This town has made arrangements to issue $25,000 bonds for building a sewerage system and water works plant, and has engaged P. Byrne of Birmingham to make plans and specifications and superintend the construction of the work.

San Jose, Cal.—A sewerage system is contemplated for the territory between the Coyote and the King-road and the McKee-road and William-st.

Chicago, Ill.—Bids are to be opened in June for constructing an additional intercepting sewer from Seventy-third to Eighty-seventh-sts., at a total cost of about $1,000,000.

Columbus, O.—Julian Griggs, Cy. Engr., has been directed to employ for the sewage disposal testing station, George A. Johnson of New York City, engineer in charge; W. R. Copeland, New York City, bacteriologist; A. E. Kimberly of Boston chemist.

CONTRACTS TO BE LET.

Lawrence, Kas.—Sealed bids are asked until June 5 for building a sewer. S. P. Moore, city clerk.

Marion, Ind.—Sealed bids are asked until 8 p. m., June 7, for building sewers: C. G. Robbins, city clerk.

Highland, Ill.—Bids are asked until June 4 for sewer pipes. Christian Koch, chairman street and alley committee.

West Point, Miss.—Bids are asked until June 7 for building eight and a half miles of pipe sewers. B. V. Rhodes, mayor.

Richmond, Ind.—Sealed bids are asked until June 6 for constructing sewers and alleys. John F. Taggart, city clerk.

Bloomfield, Mo.—A contract will be let June 6 for constructing ditches in drainage district No. 5. A. C. Spiker, engineer.

Aberdeen, S. D.—Bids are asked until 8 p. m., June 13, for extending the sewer on Main-st., from Railroad to Oak. M. Stroppe, cy. audt.

St. Louis, Mo.—Sealed bids are asked until June 3 for constructing sewers in Quincy and Filmore-sts. Hiram Phillips, prest. B. P. I.

Washington, D. C.—Sealed bids are asked until 12 m. June 4 for constructing a portion of the sewage disposal system outfall sewer. H. B. F. MacFarland, chmn. dist. comrs.

Orange, N. J.—Bids are asked until June 6 for building 2,200 ft. of 12-in. vitrified pipe, manholes, etc., in Sherman, Dodd and Thomas-sts. F. T. Crane, cy. engr.

Buffalo, N. Y.—Sealed bids are asked

Ashtabula, O.—Sealed bids are asked until June 11 for building 2,600 ft. of 8-sewer, 3,100 ft. 4-in. house connections manholes, etc. A. J. Richardson, B. P. S.

Marshall, Mo.—Sealed bids are asked until June 6 for constructing 14,915 ft. 6, 8, 10, 12 and 15-in. pipe sewers, "Miller" flush tanks, 30 manholes and lamp holes. A. R. James, cy. clk.

Lorain, O.—Sealed bids are asked u 12 m. June 4 for building sewers and purtenances in Chestnut, Dexter, W and Kent-sts. and W. Erie and Lake aves. J. J. Mahoney, clk B. P. S.

Omaha, Neb.—Sealed bids are asked til June 3 for constructing a section the Saddle Creek sewer from Califor st. to the septic tank and filter pl Andrew Rosewater, chm. B. P. W.

Chicago, Ill.—Sealed bids are asked til June 7 for constructing a system brick sewers having a total length 15 mis.; also for the construction o pumping station building with boi room; erection of four centrifugal pu ing engines with water tube boilers all necessary appurtenances. A. Lynch, prest. bd. local impvts.

New Orleans, La.—Sealed bids are as until July 7 for constructing 4,400 lin. of reinforced concrete canal; laying ft. 30 and 36-in. vitrified clay pipe placing one 36-in. flushing valve; 4,500 reinforced concrete canal; laying 2,500 30 and 36-in. vitrified clay pipe and p ing three 36-in. flushing valves; constru ing 22,600 ft. wood-lined canal. Sealed will also be received until July 7 for structing two pumping stations, cont ing 41,000 ft. piling, 8,500 cu. yds. exca tion, 3,500 cu. yds. concrete, superstr tures of five pumping stations, etc. F Shields, secy. sewerage and water bd.

Buffalo, N. Y.—Bids are asked u June 3 for a sewer in Eighteenth Francis G. Ward, Dir. pub. wks.

Westpoint, Miss.—Bids are asked u June 7 for building 8½-mis. of sew B. V. Rhodes, mayor.

Orange, N. J.—Bids are asked until J 6 for building sewers, with manholes, F. T. Crane, cy. engr.

Tallahassee, Fla.—Bids are asked u June 22 for constructing a sewerage s tem. A. H. Williams, cy. clk.

Torrington, Conn.—Bids are asked u June 7 for a sewer in Summer-st., v appurtenances. F. F. Fuessenich, com

Cincinnati, O.—Sealed bids are as until June 7 for a sewer in 8th-st., f Carr-st. to Freeman-ave. Geo. Holmes, clk. B. P. S.

Corry, Pa.—Bids are asked until J 6 for 10,106 ft. of sewers, with manho catch basins, concrete Y-branches. N. R. Dickson, cy. engr.

Washington, D. C.—Bids are asked til June 18 for constructing a portion the low area trunk sewer. H. B. MacFarland, chmn. Dist. Comrs.

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Reading, Pa.—Bids are asked until June 27 for repairs and additions necessary to increase the capacity of the sewage disposal plant at Wilmont. E. H. Beard, cy. engr.

Fairview, Mich.—Sealed bids are asked until June 8 for building a sewer in Jefferson-ave., from the eastern city limits to Cadieux road, and for a septic tank, sewage pumping station, pumping machinery and steam boilers. Walter E. Jarvis, vil. clk.

CONTRACTS AWARDED.

Altoona, Pa.—Sewer contracts have been awarded to Isaac Bender, C. B. Clark and W. W. Saupp.

Alton, Ill.—The contract for building a sewer in Rudge-st. was awarded to Aug. Manns for $3,152.60.

Chickasha, I. T.—The contract for a sewerage system was awarded to Doyle & Schwartz for $15,000.

Nashville, Tenn.—The contract for a sewer in Belleville-st. was awarded to J. T. Allen for $7,545.50.

Hartford, Conn.—Michael O'Neil was awarded the contract for a sewer in Woodland-st. and Harrison-place.

Syracuse, N. Y.—The contract for constructing a tunnel sewer was awarded to Thomas Marnell for $74,970.40.

Moscow, Idaho—James Broad of Spokane secured the contract for completing the trunk lines of sewerage for $70,000.

Cedar Rapids, Ia.—The contract for a storm sewer in Central Park was awarded to Wm. King & Co. for $9.40 per lin. ft.

Scranton, Pa.—The contract for building section G of the 17th sewer district was awarded to Engli & Co., at $4.50 per lin. ft.

Duluth, Minn.—Sewer contracts were awarded May 16 as follows: 12th-ave., J. W. Preston, $4,624.50; 10th-ave., George R. King, $5,976.50.

Pullman, Wash.—The contract for constructing a sewerage system in the business section of this city was awarded to J. B. Hicks, for $3,560.

Charleston, S. C.—The contract for the extension of the intercepting sewer at the Navy Yard was awarded to the Simons-Mayrant Co., for $5,242.

Westfield, Mass.—The contract for constructing two sections of the storm sewer system was awarded to Seymour, Clark, Hills & Co. of Springfield, for $11,004.75.

Monterey, Mex.—The contract for the construction of a water works and sewerage system has been awarded to the National Water-Works & Guarantee Co. of Scranton, Pa., for $3,000,000.

Fitchburg, Mass.—The contract for building a sewer in Daniels-st. was awarded to S. S. & H. N. Lawrence at $6.31 a cu. yd. for cement concrete masonry and $11.31 for brick masonry.

Duluth, Minn.—Sewer contracts have been awarded as follows: Grand-ave., J. D. O'Connel, $2,773.50; two alleys, Thomas & McCoy, $1,436.05 and $1.782.05, respectively; an alley, Pastoret & Lunz, $2,470.50.

Buffalo, N. Y.—Special.—Bids were received for constructing a 36-in. force main in the Hamburg overflow sewer in Hamburg-st., as follows: Bardol & Roberts, 400 D. S. Morgan Bldg., $26,800; H. P. Burgard, 560 Walden-ave., $34,100; Geo. W. Moore, 117 Elk-st., $34,948; Thos. McKeown, 27 Winspear-ave., $35,000; Joseph F. Stabell Co., 1127 Niagara-st., $35,980.

Los Angeles, Cal.—Bids were received May 16 for building the new outfall sewer as follows. Miller & Franklin, Buffalo, N. Y.—Section 1, $82,600; section 2, $86,800; section 4, $99,400; section 5, $142,000; section 6, $60,000. Hansbrough & Herman, Los Angeles—Section 3, $247,500. Atlantic, Gulf & Pacific Company, San Francisco—Sewer complete, $717,000. Williams & Belser, San Francisco—Section 5, $144,989; section 6, $54,787. C. D. Vincent, Oakland—Section 1, 54,986; section 4, $93,983. Tyron-Brain Company, Los Angeles—Section 2, $121,000. A. P. Pusish, Los Angeles—Section 2, $73,000. A. F. Nims, Philadelphia, Pa.—Section 1, $59,505; section 2, $76,914. Los Angeles Construction Company, Los Angeles—Sewer complete, $698,000.

Pittsburg, Pa.—Sewer contracts were awarded May 19 as follows: Alley, Thos. Barrett of Wilmerding, $1,496; Stoakes-ave., Ott Bros., city, $1,819.68.

Syracuse, N. Y.—The contract for building a tunnel sewer in the Fourth Ward was awarded to Thos. Marnell, May 23, for $75,000; Anna and other streets, $5,411.50, and Amherst-ave. and other streets, $1,331.50, James Swift; Lexington-ave., C. T. Hookaway, $1,084.

WATER-WORKS.

Bucyrus, O.—M. J. Breese of Galion and C. W. Wiles of Delaware have been appointed receivers for the Galion Water-Works Co., upon the application of David S. Gray of Columbus.

CONTEMPLATED WORK.

Waukon, Ia.—Council voted to purchase a new pump.

Niles, Mich.—The water mains on Lincoln-ave. will be extended.

Corning, Ia.—The extension of the water system is contemplated.

Farmington, N. H.—The extension of the water supply is contemplated.

Waverly, Ia.—About six blocks of water mains will be laid this summer.

Iowa Falls, Ia.—About $8,000 will be expended on waterworks improvements.

Renville, Minn.—The question of building waterworks is being discussed.

Watertown, N. Y.—The construction of water mains on Court and Factory-sts. is proposed.

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Hardwick, Vt.—This village voted to increase the water supply. L. H. Warren, vil. trustee.

Houghton, Mich.—Plans for improving the water-works system are being made by F. W. Cappelen.

Ladysmith, Wis.—This village will vote June 4 on the question of extending the water-works system.

Waterville, Mo.—Preliminary surveys are being made for the proposed pipe line from this city to China Lake.

Redding, Cal.—A new pumping plant and reservoir will be installed for the improvement of the water supply.

Lockport, N. Y.—Charles A. Hague, hydraulic engineer of New York city, recommends the Niagara River for a water supply.

Whitman, Mass.—This town voted to appropriate $20,000 for obtaining a water supply from Brockton. J. C. Gilbert, chm. comrs.

Rockport, O.—An ordinance has been passed to issue $75,000 bonds for the construction of water works. J. C. Seager, mayor.

Massillon, O.—The question of issuing $200,000 bonds for building and maintaining a municipal water plant will be voted on June 21.

Lawrence, Mass.—The International Sewage Disposal Co. has submitted a new proposition to the city for building a filter for the water supply.

Alliance, O.—A resolution has been adopted to issue bonds for enlarging and improving the water works system. Chas. O. Silver, clk. coun.

Jackson, Miss.—Special.—Wm. Hemingray, mayor, says this city will vote June 2 on the question of municipal owenrship of all public utilities.

Brownfield, Pa.—The Redstone Water Co. contemplates the erection of dams, reservoirs, pipe lines, etc., in Georges twp., to furnish South Union with water

Sylacauga, Ala.—Special.—This city has engaged J. Byrne of Birmingham to prepare plans and specifications and superintend the construction of a water works system.

The question of issuing water works bonds has been favorably voted on as follows: Kingman, Kas.; De Queen, Ark.; Montgomery, Ala.; Mora, Minn.; Strasburg, Va.; Franklin, Tenn,; Roland, Ia.

Punxsutawney, Pa. — The water company has decided to abandon the present pumping station and to replace the small reservoir south of Lindsey by one with a capacity of 2,500,000 gallons.

superintend construction of the wat works. Charles E. Stevens, Clk.

The construction of water works sy tems is contemplated at the followir places: Bartlesville, I. T.; Hancoc Minn.; Janesville, Minn.; Java, S. D Kensington, Minn.; Jellico, Tenn Wheatland, Cal.; Troy, Idaho; Manito Man.; Summerside, P. E. I.; Spart Tenn.; Covington, La.; Oriskany Fall N. Y.; Mt. Vernon, S. D.

Casey, Ill.—A water works system contemplated.

CONTRACTS TO BE LET.

Fargo, N. D.—Bids are asked until Jun 6 for a six-inch main in Second-st. H J. Gibson, city auditor.

Woodville, Miss.—Sealed bids are aske until June 7 for a water works systen W. C. Miller, mayor.

Hillsboro, N. D.—Bids are asked unt June 6 for the extension of the wate works system. Thomas Forde, city aud tor.

Winona, Minn.—Bids are asked unt June 6 for 140 tons of c. i. water pipe an specials. G. P. Coleman, city engineer.

White Hall, Ill.—Sealed bids are aske until June 7 for laying a water main o Grant-st. L. N. Sheardy, city clerk.

Atlantic City, N. J.—Sealed bids ar asked until June 3 for constructing pump well at the Absecon pumping sta tion. Louis Kuehnle, chm. water comr

Milwaukee, Wis.—Sealed bids are aske until June 15 for furnishing and erectin a pumping engine at the North Poin pumping station. Chas. J. Poetsch, chm B. P. W.

Canton, O.—Bids are asked until Jun 27 for furnishing and erecting a vertic triple-expansion pumping engine, thre boilers and three stokers or furnace Louis B. Ohliger, Supt. W. W.

Hays, Kas.—Sealed bids are asked unt June 8 for constructing a water pipe lin including settling basin, man-holes, etc from Big Goose Canon to U. S. reservoi Thos. Swobe, Q. M.

Cincinnati, O.—Sealed bids are aske until June 10 for laying c. i. pipe, specia castings and valves for the pump main from the western pumping station, et Aug. Herrmann, prest. bd. trustees.

Erie, Pa.—Bids are asked until June 3 for furnishing and laying about 9994 fee of intake pipe, five feet five inches gat valves, timber intake crib, specials an connections. Geo. C. Gensheimer, secy w. w. comrs.

Hawkinsville, Ga.—Bids are asked unti June 13 for constructing a brick pumpin

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system was awarded to O'Brian & Rhoades of Denver for $35,000.

Brownsville, Tex.—A franchase for a water and light plant has been granted to Judge James B. Wells.

Columbus, O.—The contract for constructing the Scioto dam was awarded to James Westwater for $237,790.

Thomas, Ok.—A franchise for a water works and electric light system has been granted to J. C. Borntreger.

New Freedom, Pa.—The contract for a water works system for this place has been awarded to W. G. Frizt of Dover, N. J.

Tishomingo, I. T.—A contract for installing a water works system has been awarded to Taylor & Moore of Houston, Tex., for $26,900.

Monterey, Mex.—The contract for a water works and sewerage system has been awarded to the National Water Works and Guarantee Company of Scranton, Pa., for $3,000,000.

Mancos, Colo. — Special. — O'Brian & Rhoades of Denver have been awarded the contract for constructing a gravity water works system for $25,000. Universal iron will be used.

BRIDGES.

Hinsdale, Mass.—This town voted to build a stone arch bridge.

Providence, R. I.—Council has passed an ordinance for issuing $25,000 bonds for bridges.

Lebanon, O.—Bids are asked until June 13 for building four bridges. S. A. Stilwell, co. audt.

Brigham, Utah.—Bids are asked until June 6 for completing Malad bridge. Jos. Jensen, co. clk.

Petersburg, Ind.—Bids are asked until June 8 for building two small bridges. T. W. Basinger, co. audt.

Evansville, Ind.—Bids are asked until June 7 for constructing a number of bridges. Bd. co. comrs.

Traverse City, Mich.—This city voted to issue $9,000 bonds for building a steel concrete bridge on W. Front-st.

Vincennes, Ind.—Sealed bids are asked until June 9 for constructing fifteen small bridges. J. D. Williams, co. audt.

Tillamook, Ore.—Bids are asked until July 4 for building a new bridge across Miami River. Homer Mason, co. clk.

Galesburg, Ill.—Bids are asked until June 6 for a bridge over Cedar Fork on Henderson-st. Roy Hopcraft, cy. ck.

Portland, Ore.—Bids are asked until June 24 for building a steel bridge on Front-st. Thos. C. Devlin, cy. audt.

Oakland, Cal.—Bids are asked until June 6 for constructing a concrete bridge across Crow Canyon. John P. Cook, clk.

Marion, Ind.—A petition has been presented to the street committee asking that a bridge be built over Boots creek at Seventh-st.

Versailles, Ind.—Sealed bids are asked until June 7 for constructing the abutments for a wagon bridge across Plum Creek. Nicholas Volz, chairman county commissioners.

Atlanta, Ga.—Sealed bids are asked until June 6 for building an abutment on the east end of Edgewood-ave. R. M. Clayton, cy. engr.

Port Republic, N. J.—Bids are asked until June 8 for a steel draw bridge over Nacott Creek. J. J. Albertson, Co. Engr., Camden.

Goldendale, Wash.—Bids are asked until July 8 for building a Howe truss bridge across Wood Gulch creek. J. H. Smith, co. audt.

Sault Ste. Marie, Mich.—Bids are asked until June 7 for erecting steel superstructures for 8 highway bridges. John E Parsille, co. clk.

New Haven, Conn.—Bids are asked until June 7 for constructing a Scherzer rolling lift bridge on Kimberly-ave. over West River. C. W. Kelly, city engineer.

Eldorado, Kas.—Bids are asked until June 8 for constructing a thirty-foot stone arch bridge across Satchell Creek, Chelsea Township. H. A. J. Coppins, county clerk.

Springfield, O.—Sealed bids are asked until June 8 for building substructures and superstructures of bridges over Mad River and Honey Creek. A. K. Hahn, county auditor.

Bucyrus, O.—Bids, plans and specifications are asked until June 9 for constructing a bridge at St. Mary-st. over Sandusky River. J. I. Smith, county auditor.

Buffalo, N. Y.—Special.—The property owners on Fulton-st. have protested against the erection of foot bridges in the vicinity of the Erie and Lake Shore crossings.

Valparaiso, Ind.—Bids are asked until June 6 for constructing a bridge in Westchester Township on the highway between Westchester and Jackson townships. Stephen P. Corboy, county auditor.

Chicago, Ill.—Sealed bids are asked until July 20 for raising the roadway of the Brandon's bridge road crossing the Desplaines River. Zina R. Carter, prest. bd. trustees.

Magnolia, N. J.—The board of freeholders has authorized the preparation of plans and specifications for a new steel draw bridge at Port Republic. J. J. Albertson, engr., Camden.

Ft. Hancock, N. J.—Bids are asked until June 20 for building about 4,500 ft. of railroad trestle and constructing 1,000 ft. of approaches at Sandy Hook. Lt. Glen F. Jenks, Ord. dept.

Mankato, Minn.—Sealed bids are asked until June 9 for building steel bridges as follows: Over Cobb River, Decoria; over Cambria Creek, Cambria twp.; Watonwan River, Ceresco twp. Edgar Weaver, co. audt.

Celina, O.—Sealed bids are asked until June 9 for constructing the substructure and superstructure for a steel bridge over Wabash River on the State Line pike one-half mi. east of Wabash. T. A. Weis, co. audt.

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STREET LIGHTING.

Clintonville, Wis.—The enlargement of the lighting plant is proposed.

Woodville, Miss.—Sealed bids are asked until June 7 for erecting an electric light plant. W. C. Miller, mayor.

Downington, Pa.—Bids are asked until June 30 for lighting the streets for one, three or five years. Isaac Y. Ash, chmn. lgt. com.

St. Joseph, Mo.—This city proposes to issue $75,000 bonds for the purpose of erecting and equipping a modern electric plant.

Monticello, Wis.—The contract for installing an electric lighting system has been awarded to Langstadt & Meyer of Appleton, for $6,950.

Vancouver Barracks, Wash.—Bids are asked until June 9 for constructing an electric lighting system at this post. F. G. Hodgson, C. Q. W. M.

Gilman, Ill.—A twenty-year franchise has been granted John Frith & Son for fourteen arc lights and 130 incandescent lights for $2,340 per year.

Nashville, Ark.—The question of issuing bonds for building a municipal electric and water plant will be voted on June 2. E. E. Husspeth, E. W. Hutchinson, J. B. Hill, members com.

Albany, Ga.—The contract for the purchase of 300 electrical horse power for a term of 10 yrs. for use in running the city's electric and water plants, will come up for ratification June 9.

Washington, D. C.—Sealed bids are asked until June 7 for electric fittings and materials and electric wires and cables for U. S. buildings east of Rocky Mountains. H. A. Taylor, acting secy. treasury dept.

St. Paul, Minn.—Sealed bids are asked until July 5 for electric light fixtures and heat register faces for the new State capitol building. Channing Seabury, vice-prest. bd. state capitol comrs.

Washington, D. C.—Bids are asked until June 3 for lighting the public streets, avenues, alleys and roads in the District of Columbia with naptha. Welsbach, etc. H. B. F. MacFarland, chm. Dist. Comrs.

Saratoga Springs, N. Y.—Sealed bids are asked until June 21 for furnishing gas or other illuminating substances for street lamps and public buildings, and for lighting, extinguishing, cleaning and keeping street lamps in order. H. F. Thomas, clk.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Auburn, N. Y.—The contract for flushing the asphalt paved streets has been awarded to Judson M. Kinley for $65 week.

Bridgeport, Conn.—The contract for disposing of garbage was awarded to Geo E. Winton of Plumb & Winton Company

McKeesport, Pa.—The contract for new garbage plant has been awarded to the Morse-Boulger Company of New York City for $14,500.

St. Louis, Mo.—Owing to an error in the ordinance calling for bids for the disposition of garbage the matter has been postponed and new bids will be asked later.

Lansing, Mich.—A petition has been submitted to the council asking that Ottawa-st. be sprinkled. A resolution has been adopted directing the superintendent of public works to purchase a new sprinkler.

TOO LATE FOR CLASSIFICATIO

Cloquet, Minn.—Bids are asked, until June 6, for grading Tenth and Eleventh sts. J. F. Ryan, cy. rec.

Minneapolis, Minn.—Bids are asked, until June 6, for graveling two roads. H. J. Scott, co. audt.

Aberdeen, S. D.—Sealed bids are asked until June 13. for extending the sewerage system. A. N. Aldrick, mayor.

Milwaukee, Wis—Sealed bids are asked until June 6, for building cement sidewalks. Chas. J. Poetsch, chmr. B. P. W.

Pine Bluff, Ark.—Sealed bids are asked until June 6, for 33,500 sq. yds. of paving, curbing and grading. T. Pearce, secy.

Trenton, N. J.—Bids are asked, until June 7, for paving Liberty-st. with brick and Stuyvesant-ave. with macadam. B. B. Salter, cy. clk.

Cleveland, O.—Sealed bids are asked until June 8, for asphalt paving on Culler-st., from Euclid-ave. to Wilbur-st. W. J. Springborn, prest. B. P. S.

Ft. Bayard, N. M.—Sealed bids are asked, until June 13, for constructing a septic tank sewage purification plant at this post. Capt. H. M. Powell, Q. M.

Oskaloosa, Ia.—Bids are asked until June 3 for 1,197 sq. yds. of brick paving, 570 ft. curbing on N. B-st.; also 5,300 ft. curbing. S. R. Crosby, cy. clk.

New Brighton, N. Y.—Bids are asked until June 10 for paving and repaving Richmond Terrace with granite blocks and Richmond and Castleton-aves. with asphalt. Geo. Cromwell, prest. boro.

St. Louis, Mo.—Bids are asked until June 7 for paving Grand-ave. with asphalt and Barton and Tenth-sts. with

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NOTICE TO CONTRACTORS.

Sealed bids will be received, at Indianapolis, Indiana, until June 8, 1904, for grading and graveling the first alley west of Hamilton avenue, from Michigan street to first alley south; North street, from Highland avenue to Oriental street; Moore avenue, from Rural to Christian streets; Weghorst street, from East to Wright streets; first alley east of Alabama street, from 24th to 25th streets; Raymond street, from Shelby street to State avenue; first alley west of East street, from Raymond to Plymouth streets. Bids will be received at the same time for constructing cement sidewalks on portions of Noble and Newman streets. Sealed bids are asked until June 1 for constructing a local sewer on Wabash street, from Illinois to Capitol avenue.

The Board of Public Works reserves the right to reject any or all bids.

M. A. DOWNING,
JACOB WOESSNER,
DAVID WALLACE,
Board of Public Works.

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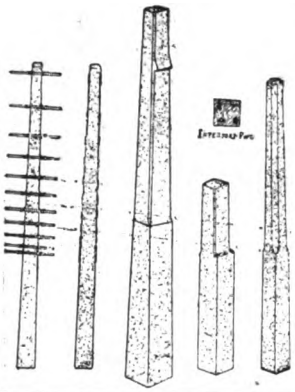

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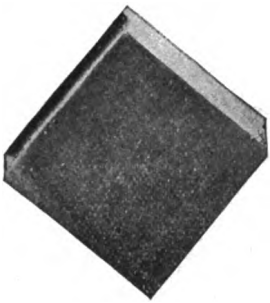

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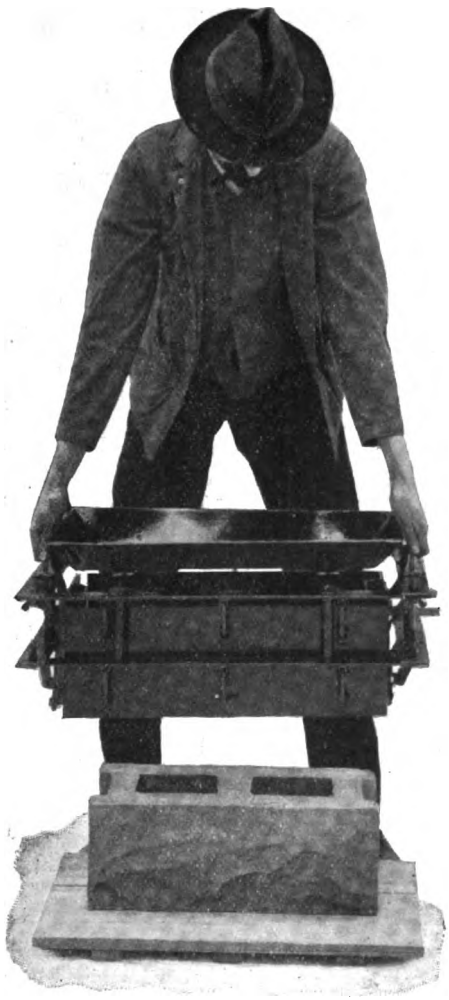

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Vol. 18,	No. 1,	Jan. 1900
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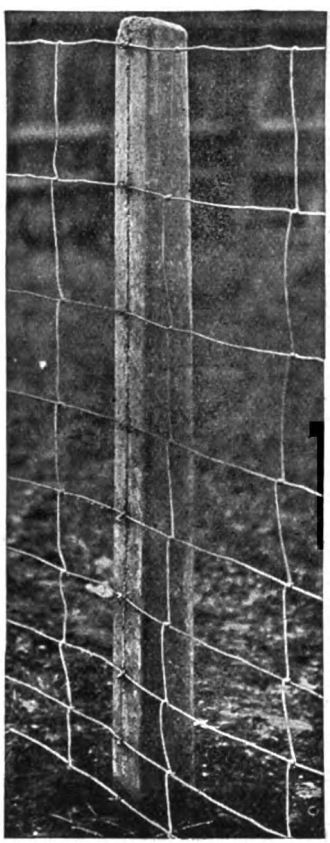
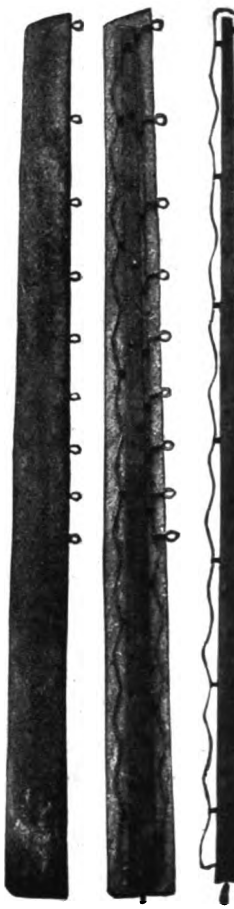


FIG. 1

FIG. 2



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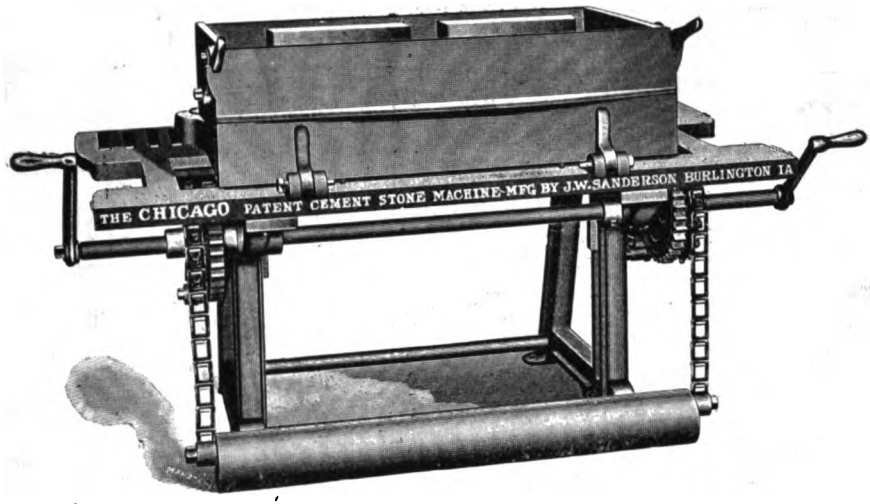

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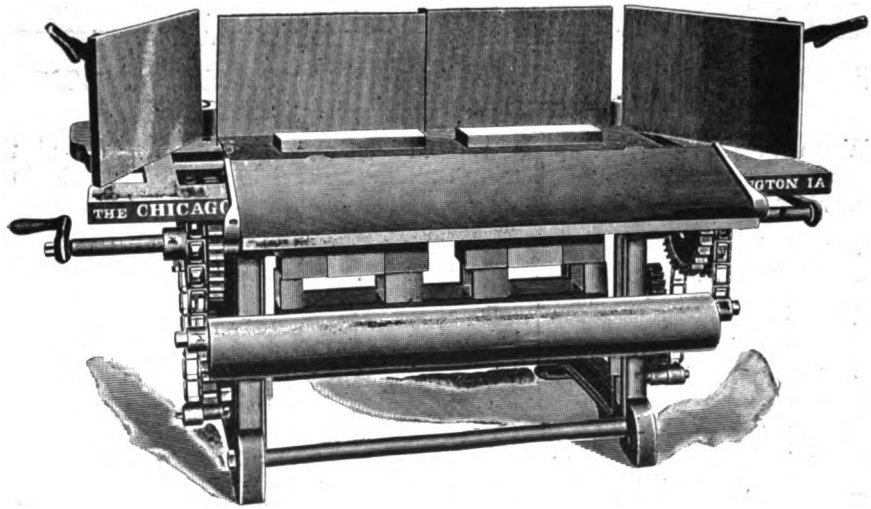

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Hutchinson, Kan.	Monmouth, Ill.	Ironton, Ohio	Oskaloosa, Iowa	Waterloo, Iowa

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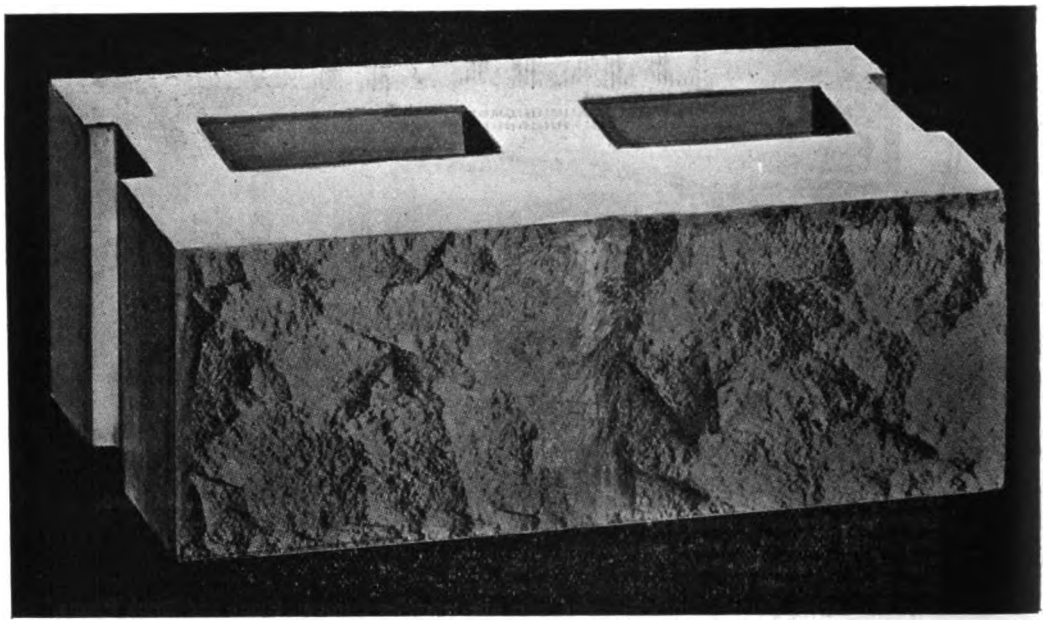
"The Lake Building and Hollow Stone Patents"



HAVE RECENTLY BEEN ISSUED FOR THE MANUFACTURE OF

PLAIN AND ORNAMENTAL BUILDING STONE

When all other methods of manufacturing Stone have been tried and their faults and failures **noted,** "The Lake Building and Hollow Stone" will be in the front ranks, **doing** a **profitable** and **satisfactory business.**

Because it is the **best** method of making building stone.
Because it makes stone in **all** forms and sizes.
Because it **does** make perfect and handsome stone.
Because it makes stone that is in great demand.
Because it is **cheaper** than natural stone and **better.**
Because it is **fire** and **water-proof** and popular.
Because it is coming surely to be a **leading** building material.
Because it is made of stone and cement and is everlasting.
Because it can be used **under** the **water,** under the earth or anywhere.
Because the **better** it is **known,** the more **popular** it becomes.
Because all builders and owners will want it when they have become acquainted with its merits and cost. Territorial rights are for sale. Full information on request. All correspondence should be addressed to

MONTFORT & WEAVER, General Sales Agents
45 Clinton Street, Newark, New Jersey

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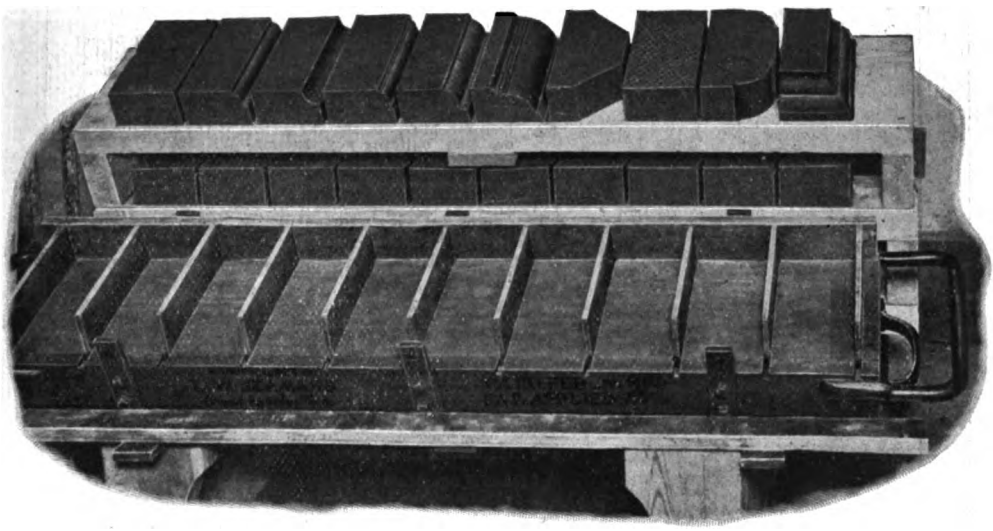
CEMENT *or* LIME
BRICK



HERE IT IS AT LAST!
Ten brick per minute any mould; be your own brick maker. If interested

ADDRESS

E. W. SEAMANS
GRAND RAPIDS, MICHIGAN

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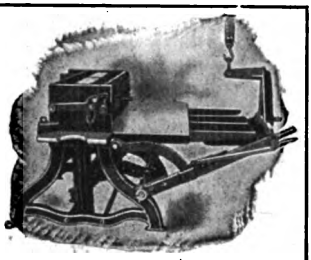
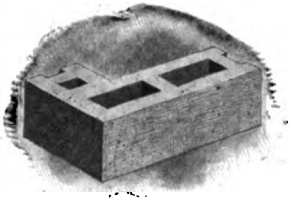
WANTED



NORMANDIN BLOCK MACHINE

ORNAMENTAL PANEL BLOCK



CHISEL FACED L BLOCK

An opportunity to take the matter of Hollow Concrete Building Block Machinery up with you. It is to your interest if you expect to engage in this business to be equipped with the NORMANDIN BUILDING BLOCK MACHINES, because they are the latest, the best and most durable machines on the market for this class of work.

THERE certainly is no better time to get into the Hollow Concrete Block business than NOW.

HUNDREDS of Normandin Machine Plants have been established. We are receiving re-orders for machines from them every day, proving to us that our machines are right.

EVERY Hollow Building Block enthusiast wants the best machine, not the cheapest, but the best for all ordinary building construction—WE HAVE THIS KIND OF A MACHINE.

NEGOTIATE for machines now. Start a "Block Yard." The business is permanent and profitable, broadening in extent every day.

ONLY secure the Normandin machines and devices for the best

RESULTS in the way of durability, economy, profit and appearance of both machines and product.

MUCH investigation is necessary in selecting a Block Machine. This is what we want. "Investigation" is the watchword of our success. We manufacture the Normandin and its devices exclusively. It's in demand because it's popular with the trade.

AND when you are all through looking allow us to take the matter up with you.

NEATLY constructed and built on the lines of simplicity —"Simplicity, the highest art of invention."

DESIGNED to save LABOR, MATERIAL and EXPENSE.

IN operation in all parts of the United States and Canada.

NEVER before until now has the demand for Normandin machines been so great. We are running our factory night and day to fill this demand.

"LOOK before you leap" in selecting Hollow Concrete Block machinery; also look up the companies manufacturing them. We are responsible and can do what we agree to do.

EASILY operated, easily adjusted, no complicated mechanism, "ten machines in one."

ARCHITECTS, contractors, builders, the leading railroads and cement workers have adopted the Normandin machines. They are universally recognized as the standard of them all.

DON'T wait until snow flies again before waking up to the Hollow Concrete Block business. The product from our machines is in demand and always will be, because our machine molds it right. It's not a question of material, but machine. We have the machine.

SEND for full printed matter today.

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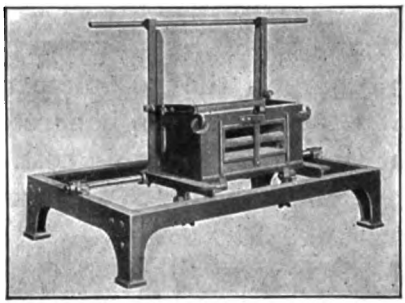
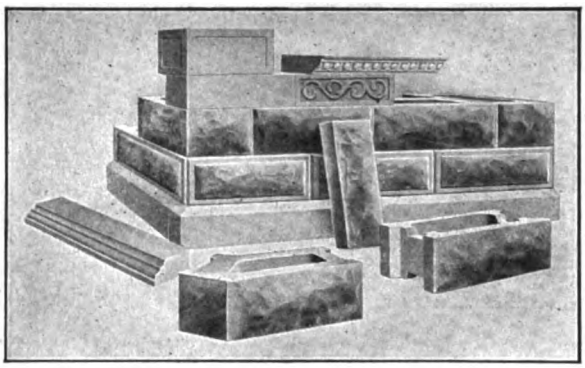
The Hercules Cement Stone Machine



and tho Wide Range of Work it Produces



NO OTHER MACHINE MADE BUT THE HERCULES
CAN PRODUCE THIS VARIETY

A Complete Stone Plant in One Machine

It makes in addition to hollow and solid blocks, water table, window sills, window caps, door sills, door caps, coping, curbing, etc., up to FIVE FEET LONG BY TWENTY-FOUR INCHES WIDE. No other machine can produce this wide range of work.

By the Hercules method you tamp directly upon the face of the design, thereby getting a most perfect impression and allowing the use of a composition 2 to 1 for facing, one inch thick and remainder of block 5 to 1. By this method, you can use crushed stone or very coarse gravel in your composition. The more crushed stone used, the stronger the block and the less cement required.

When you buy a cement block machine the saving of material is an important factor. Let us send you our Catalogue A and full information. Write us today.

The Century Cement Machine Co.

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Just Pour It

And the **water** does the rest—**compacts** the ma
without tamping; compels the complete crystallization
the cement; **makes stone** (not concrete) of the highe
possible quality at the lowest possible cost. **The ston**
is of correct shape for economical laying.

Results: With the **Dykema Mold** you can mak
stone with which you can take contracts at **10 pe**
cent. under brick and make **40 per cent. profi**
The only system which competes wit
brick. BOOKLET NO. **1** TELLS MOR

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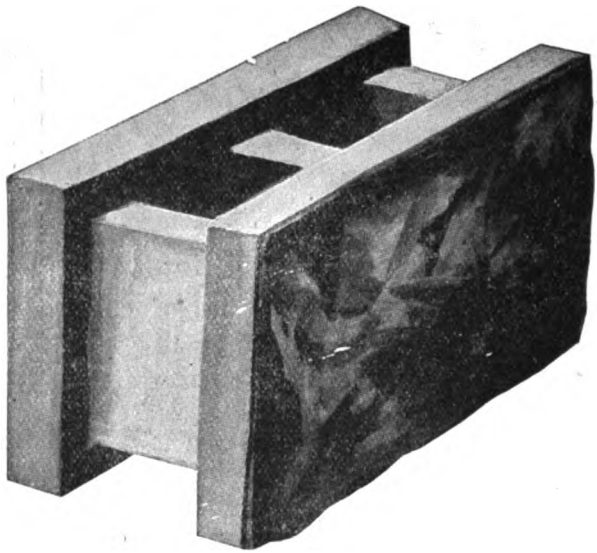
THE STEVENS CAST STONE

THE MOST PERFECT MANUFACTURED STONE YET OBTAINED

PRODUCED WITHOUT TAMPING OR PRESSURE

We warn all parties against making stone as shown by this cut, as it is broadly protected by our patents.



This cut shows stone patented by Chas. W. Stevens in May, 1902, upon which eight claims are allowed, three of which being as follows:

1. An artificial building stone comprising two outer walls spaced apart and connected together by posts formed integrally therewith, substantially as described.

2. An artificial building stone comprising two oppositely disposed walls spaced apart and connected together, the space between said walls being uninclosed on four sides, substantially as described.

3. An artificial building stone comprising outer parallel walls spaced apart and connected together, *the space there between being open on all sides not inclosed by said outer walls*, substantially as described.

The Stevens Hollow Block Machine is entirely different from anything now on the market. Under one of our processes, in which the material is poured into the mould, we withdraw the core instantly, which obviates all danger of cracking or **defacing** the stone. **Sixty of our cores will produce** as much stone as can be made with 1500 cores of another make being advertised and which is an imitation of our methods.

Write for our new reading matter and figure on making this splendid building material for your county.

STEVENS CAST STONE CO.

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Congress has adjourned, the Preside tial Campaign has begun, the boom building with the Harmon S. Palme Hollow Concrete Blocks is on

In this Magazine, January, 1902, was printed the first notice of The Harmon S. Palmer's System of Building with Hollow Concrete Blocks. The only one known in the world at that time; he being the pioneer and originator.

Behold what a smoke a little fire kindleth!

After years of perimenting, t sands of dollar pended by hi convince the s tical of the pr cal use of Ho Concrete Blo improvements ed to impro ments, he pl upon the mar perfect mac capable of ma all kinds of bl needed for b ings, elimina all danger of cr when RIGH made.

See editorial com in May number o magazine.

Residence of Harmon S. Palmer, 1450 Binney Street, Washington, D. C.
Made of his patented blocks; the columns of Steven's process

This machine was advertised and sold throughout the whole country. *Its success instantaneous!* Seeing this, infringers, imitators, copyists, who had purchased or usec Harmon S. Palmer Block Machines, took it as a pattern, and afterwards reached ou *deceive the public* by offering them for sale. In consequence there are now pending in the United States Courts and an interference case in the U. S. Patent Office. *Be buying, look up the facts.* It will save you time, trouble and money afterwa

MACHINES AND TERRITORY FOR SA

WANTED—We want the name of every party selling, buying or using any Hol Concrete Building Block Machines, as well as the location of every building ere with Hollow Concrete Building Blocks without our license, and for first informa we will pay a reward. **We have six years in which to begin action.**

It is not easy to do justice to this machine by a bare advertisement. If you are in d write to us and we will tell you how to get into the business on the ground floor.

HARMON S. PALMER
BUILDING BLOCK COMPANY

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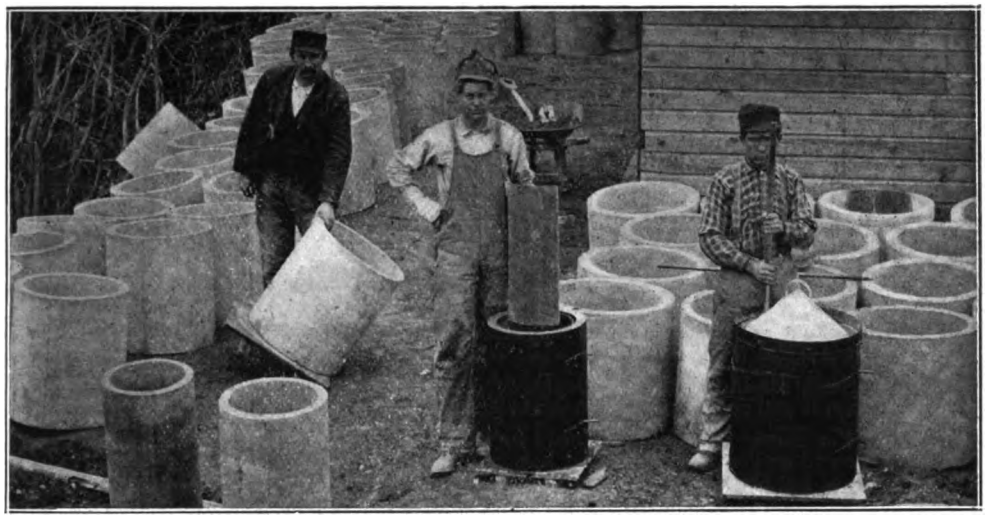
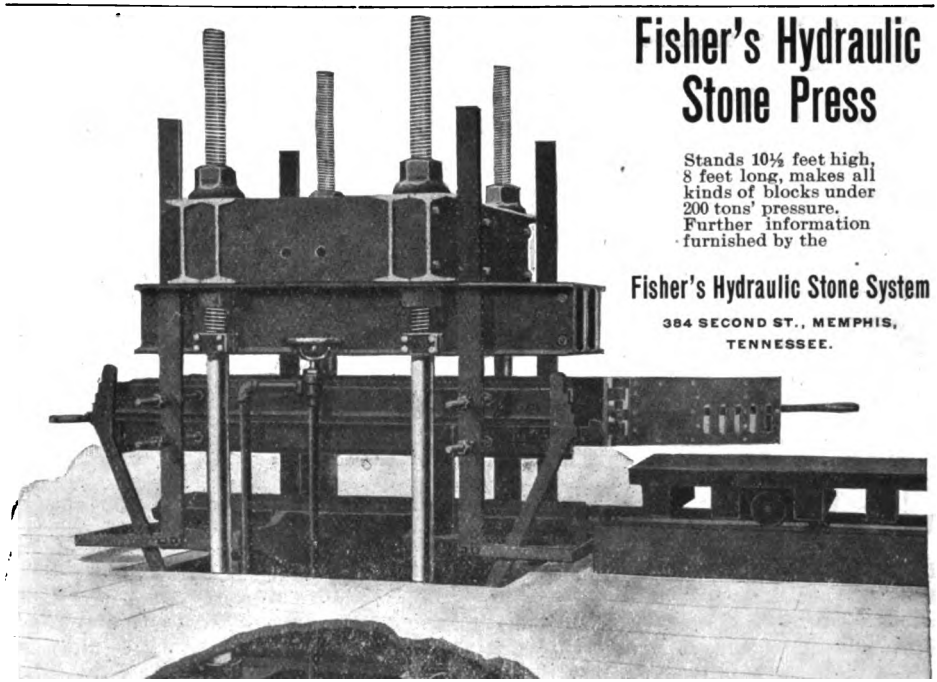


-(PATENTED)

The only practical Cement, Tile and Sewer Pipe Mould made. Any sized tile above 10 inches can be made at a big profit; can be sold for less than clay sewer pipe and is superior to any clay tile made. Road, Well and Drain Tile as well as Sewer Pipe can be made with same mould, attachment furnished for making Bell Top Sewer Pipe. One 18 inch core, $15.00, one outside mould, $14.00, hopper and tamp $4.00. Twenty outside moulds can be used to 1 core and hopper; core is removed as soon as tile is made. Outside mould can be removed in five hours. Nothing to wear out, no complicated machinery. Send for circulars giving full information.

CEMENT TILE AND TILE MOULD MANUFACTURING CO., SAC CITY, IOWA.


Fisher's Hydraulic Stone Press
Stands 10½ feet high, 8 feet long, makes all kinds of blocks under 200 tons' pressure. Further information furnished by the
Fisher's Hydraulic Stone System
384 SECOND ST., MEMPHIS, TENNESSEE.

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"INDURATION by ABSORPTION

THE KEYNOTE TO
PERFECT STONE-MAKING

No Other Process Approaches It In Any Particular.

The simplicity of operation and perfection of results attained, places it at once FAR AND AWAY BEYOND reach of competition.

Send for illustrated catalogue explaining everything in detail. Write to-day; it will only cost you two cents to find out all about it.

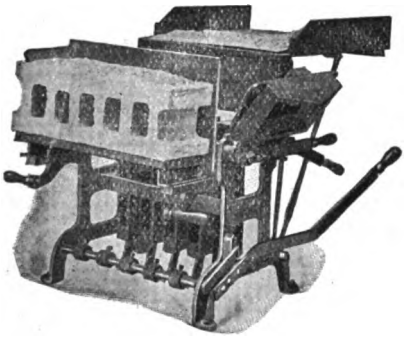
For nearly two hundred years inventors have been trying to discover a means to create a perfect bond between the atoms of the stone composition, but not until now has this been accomplished.

We can not explain all about this great invention in a brief advertisement, and therefore ask a careful reading of our literature, before you invest a cent in any other process.

We have the absolute endorsement of every practical engineer who has investigated our methods, and the universal verdict is, **"You have solved the problem."** DO NOT BE DECEIVED BUT OBTAIN THE BEST. Address

The Standard Stone Co. of America

140 Nassau Street, NEW YORK or **206 N. Liberty Street, BALTIMORE, MD**



"THE SIMPLICITY"

The Simplicity Building Block Machine

For the manufacture of hollow or solid concrete building blocks. Adjustable for all sizes and shapes. Delivers the block on its side, a saving of labor. Wood pellets are used; other machines use iron pellets, a full set of which cost as much or more than price asked for our complete machine. CONSIDER WELL BEFORE PURCHASING. Agents wanted in every state.

THE STANDARD SAND & MACHINE COMPANY
CLEVELAND, OHIO

Manufacturers of Mixers, Screens, Dryers, Conveyors, etc. for equipping Building Block and Wall Plaster Plants.

Ask for catalogue and prices.

CEMENT WORKERS—ATTENTION

Do you want the latest, up-to-date Moulds for the manufacture of a Standard Cement Block for building purposes? Any style of block, also moulds for Water Tables, Chimney

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The Little Wonder

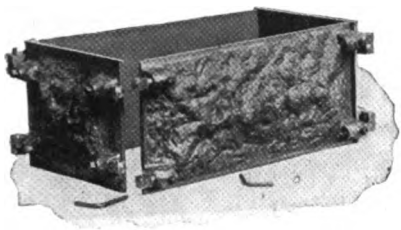
Battjes Cement Stone Machine is a winner.

No contractor can afford to be without this machine. Capacity Great, Product Perfect.

If you want to get in the cement stone business investigate today.

Catalogue No. 2 tells more

Battjes Fuel & Building Material Company, Grand Rapids, Mich.



$25.00

Buys one of our Combination Stone Outfits.
Produces Stone in three styles at lowest cost.
Rock faced, Tooled and Plain.
Blocks for corners, window weights and joists
Half blocks for breaking joints.
No cutting or "dutchman" needed.

SEND FOR BOOKLET "E" WHY PAY MORE?

THE CEMENT WORKING MACHINERY CO.

7-9 Jefferson Avenue, Detroit, Michigan.

SOMETHING NEW

The only Portable Cement Sidewalk Block Machine Made

Will make blocks any desired shape and thickness
Up to twenty-four inches square and four inches thick

Made of All Iron and Steel and will Last a Lifetime

SATISFACTION GUARANTEED
WRITE US FOR FURTHER PARTICULARS

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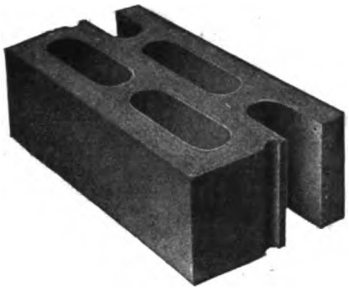
OUR PLAN Makes it Possible fo Every Builder to Mak



Patented June 9, 1903

MIRACLE'S PATENTED CONCRETE BLOCKS

Economically and in quantities to suit his needs. **Which** of these outfits can you use
1. Hand Tamp Molds. 2. Hand Power Press. 3. Complete Power Equipmen

WRITE US FOR FREE FACTS

and let us post you on the money-making opportunities that await you—by **our plan**
MIRACLE'S (patented) **CONCRETE BLOCKS** are cheaper and better than bric
and cost but one-third as much to lay. Fire, frost and damp-proof. The **only** doub
air-spaced hollow block. Write

THE MIRACLE PRESSED STONE CO., 602-3 Northwestern Building **MINNEAPOLIS, MINI**

SEAMANS' BUILDING BLOCK MACHINE

ALL THAT ARE NECESSARY FOR A COMPLETE PLANT

for making foundation blocks, water tables, building blocks, with continuous air spac
wall or not, as desired, half blocks to butt up against window and door jambs, fracti
blocks, window sills, window and door caps, blocks for gables at any pitch, angle bl
at any angle, for bay windows, etc., building veneers of any thickness, chimney flue
fact all blocks necessary for complete building of any kind can be made with Seam
Building Block Machines.

Can you do it with any other make of machine?

Manufactured by E. W. SEAMANS, 97 Ottawa Street, Grand Rapids, Michi

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THE "IRON KING" AUTOMATIC FRICTION DRIVE CEMENT PACKER

STRONGEST, FASTEST AND MOST DURABLE FOR BARRELS. MORE IN OPERATION THAN ALL OTHER MAKES COMBINED.

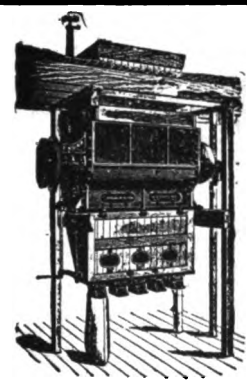
THE "JEWEL" IRON FRONT SACK PACKER

The S. Howes Company

"EUREKA" WORKS, SILVER CREEK, N. Y.

ESTABLISHED 1856

New York Office, 11 Broadway, J. B. Parnall. Chicago Office, 11 Traders Bldg., B. F. Ryer



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MIXER FOR CEMENT

SEND FOR CIRCULAR B.

W. D. DUNNING, - Syracuse, N. Y.

STEEL CONSTRUCTION

TRUSSES, GIRDERS, ETC.

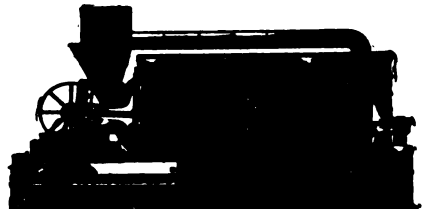
CORRUGATED IRON

TANKS STACKS

RIVETED PIPE

Wm. B. Scaife & Sons Company

ONE OF OUR GRILL 4 COMPARTMENT ROTARY DRYERS No. 2. STYLE "C" WILL DRY 100 TONS OF COAL PER DAY



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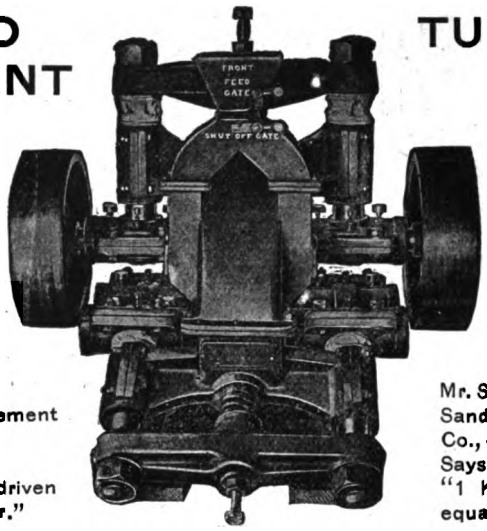
KENT CEMENT PULVERIZER

FINISHED CEMENT

10 BBLS. PER HOUR

97% 100 MESH



TUBE MILL FEED

40 BBLS PER HOU

98% 20 MESH

Mr. W. J. BELL, Supt. Newaygo Portland Cement Co., Newago, Mich., Says:
"4 KENT MILLS are driven by one 75 H. P. motor."

Mr. S. B. NEWBERRY, Mg Sandusky Portland Cemer Co., Syracuse, Indiana, Says:
"1 KENT MILL is near equal to four Ball-Mills."

THE KENT MILL NEVER TAKES OVER 25 H. P.

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Of special interest to those contemplating mill or factory improvements.
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CEMENT MACHINERY

ROTARY KILNS. FIVE DIFFERENT DESIGNS
BALL MILLS AND FOR BOTH WET AND

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90% WILL PASS A 10,000 SIEVE

We are now grinding all cement so that 90% will pass through a 10,000 mesh sieve.

This increases its efficiency 25% or more.

You can accomplish, with out increased cost, more work with a given quantity, as the finer the cement the greater its sand-carrying capacity.

Louisville Hydraulic Cement

Thus improved, meets the demand for a very finely ground, reliable cement for brick, stone or concrete construction.

Western Cement Co.

271 W. Main St., Louisville, Ky.

Webster

ELEVATING and CONVEYING

Machinery

FOR USE IN

Cement Plants

We manufacture a complete line and have equipped many of the largest works in this country with our specialties.

Send for Catalogs

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Official Tests of Peninsular Portland Cement and testimonials of well known Competent Engineers furnished on application.

SHOWS GREATEST GAIN IN STRENGTH WITH AGE

PENINSULAR PORTLAND CEMENT JACKSON, MICH.

WILL TAKE MORE SAND THAN ANY OTHER CEMENT

TRADE MARK.

PENINSULAR PORTLAND CEMENT CO
GENERAL OFFICE, JACKSON, MICH.
Write for Illustrated Booklet.

The Kielberg Molding Pro
For Making Cement Pipes
Pipes for sewers, water supply, irriga
plants, etc., made by the Kielberg P
are stronger, more waterproof and smoo
internally than any other yet known pi
They have exact dimensions and excel
joint fittings. The machinery is extensi
used in Europe, South Africa, Australia,
WRITE FOR FURTHER INFORMATIO
H. SCHEBYE, C. E.
348 Carolina Street, Pittsburg, Pennsylva

FRICTION CLUTCHES AND
SPEED CHANGES
FOR CEMENT PLANTS.
THE MOORE & WHITE CO.,
PHILADELPHIA.

KOMINUTERS, BALL MILLS & TUBE MILL
MODERN GRINDING MACHINERY
FORGED STEEL BALL
F. L. SMIDTH & COMPANY, 39-41 CORTLANDT ST., NEW YO

KRUPP
GRINDING MACHINERY
STEEL TIRES & WHEELS
SHAFTS & FORGINGS
THOS. PROSSER & SON, 15 GOLD ST., NEW YORK; OLD COLONY BLDG., CHICA

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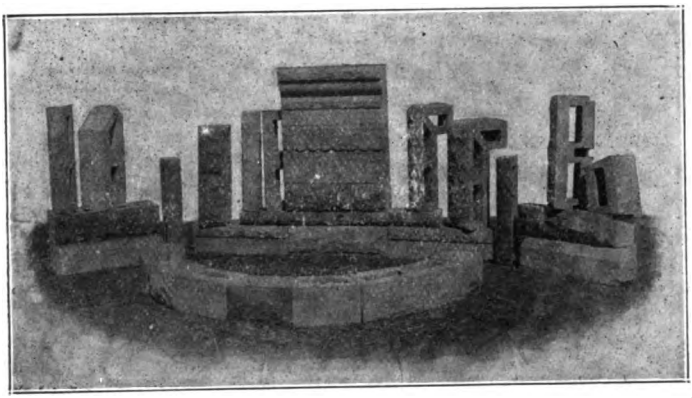

WINGET BUILDING BLOCK MACHINE

These and many other designs can be made on one and the same machine.
The "Winget" is capable of more adjustments and adaptations than any machine ever devised.

A. D. MACKAY & CO.
Chamber of Commerce
Chicago. General Sales Agents.

WORKS
Coplay, Pa.

MAIN OFFICE:
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COPLAY CEMENT MFG. CO.

SAYLOR'S PORTLAND CEMENT

HIGHEST GRADE AMERICAN PORTLAND.
COMMERCIAL AND XLNT PORTLAND CEMENTS.
IMPROVED ANCHOR.
COMMERCIAL AND ANCHOR ROSENDALE CEMENTS.

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OMEGA

Exact Composition.
Correct Chemical Analysis.
Burned in Rotary Kilns.
Ground in Ball and Tube Mills.

THE OMEGA PORTLAND CEMENT CO.,

OMEGA PORTLAND CEMENT CO. JONESVILLE, MICH.

ITS PRODUCT IS SEASONED

Before shipping and guaranteed to withstand satisfactory neat and sand tensile strains—cold and hot water tests; chemical and sieve tests. We grind 98 per cent. fine on sieve of 20,000 meshes.

Jonesville, Michigan.

Cayuga Brand Portland Cement

Leading High Grade Portland Cement
In America. Write for Prices.

MANUFACTURED BY

CAYUGA LAKE CEMENT CO., - ITHACA, N. Y.

CAYUGA LAKE CEMENT COMPANY
CAYUGA PORTLAND CEMENT
ITHACA, N.Y.

"MILWAUKEE HYDRAULIC CEMENT"

CAPACITY 5,000 BARRELS PER DAY.
ANNUAL SALES, 400,000 BARRELS.
CORRESPONDENCE SOLICITED.

For Uniformity of Grind and Ultimate Strength it is Unrivalled.

MILWAUKEE CEMENT CO., MILWAUKEE, WIS.

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MEACHAM & WRIGHT COMPANY

SALES AGENTS

IMPROVED UTICA HYDRAULIC CEMENT

AND DEALERS IN IMPORTED AND AMERICAN PORTLAND CEMENT

920-921 CHAMBER OF COMMERCE BLDG... CHICAGO

GIANT PORTLAND CEMENT

THE OLD RELIABLE

OVER 10,000,000 BARRELS

OF "GIANT" PORTLAND—"IMPROVED UNION"—"UNION"

CEMENT

USED ON THE MOST IMPORTANT WORK IN THE UNITED STATES

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Agencies: { Lesley & Trinkle Co., 22 South Fifteenth Street, Philadelphia, Pa.
United Building Material Co., 13-21 Park Row, New York; 101 Milk Street, Boston, Mass.

NEW JERSEY | UNEQUALED

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IS THE STANDARD AMERICAN BRAND

Endorsed and used by all Civil and City Engineers throughout the Country.

The U. S. Gov't gives it the preference over all other brands.

Atlas Portland Cement Company,

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Boonton, N. J.
LOADED WITH 25 TONS STEEL RAILS
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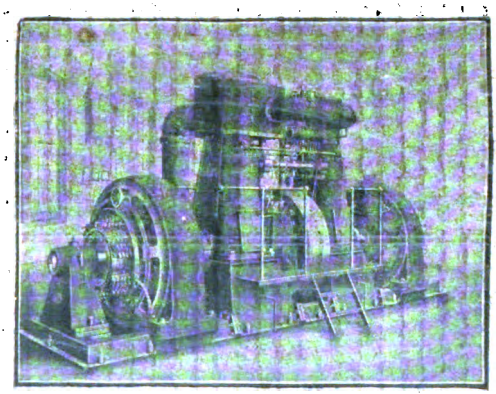

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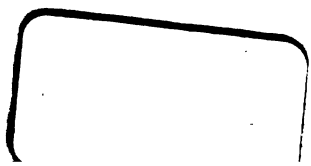

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